AMERICAN MACHINIST

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Improved Hoisting Machinery.

We illustrate herewith three of the hoisting machines made by Williamson Bros., Philadelphia. The wharf crane has two motions by power, viz.: hoisting and revolving. It revolves around a heavy steel post, the lower end of which is secured in the base. The thrust of the load is against a brass collar and washer at the top of the post, so that the strain on the post is tensile only.

It has a double engine fitted with link motion and also a lowering brake, so that the load can be lowered either by reversing the engines, or by the use of the brake.

The jib is of wrought iron, and all parts are made strong and durable.

The revolving part of the crane rests on wheels which move on a circular track; motion in either direction is accomplished by means of a double cone friction clutch.

The platform extends back sufficiently to provide for placing weights to counter-balance the load.

These cranes are also made, when desired, with boiler attached, and arranged to be traveled by the power of the engines, and to change the radius of jib.

The ship hoist is a frictional geared hoisting engine, combined with spur gear for hoisting anchor, etc. The drum for hoisting cargo is driven by friction, and an extra shaft driven by spur gearing, carries the messenger chain wheel for hoisting anchor, and for the winch heads. This shaft is thrown out of gear by disengaging clutches when hoisting or discharging cargo, thus relieving the wear of the spur gearing, and doing away with its noise.

The engine is complete with copper coil condenser, a 250-gallon tank, circulating pump, messenger chain wheel for hoisting anchor, rope wheel for driving ship pumps, two winch heads for hoisting sail, etc.

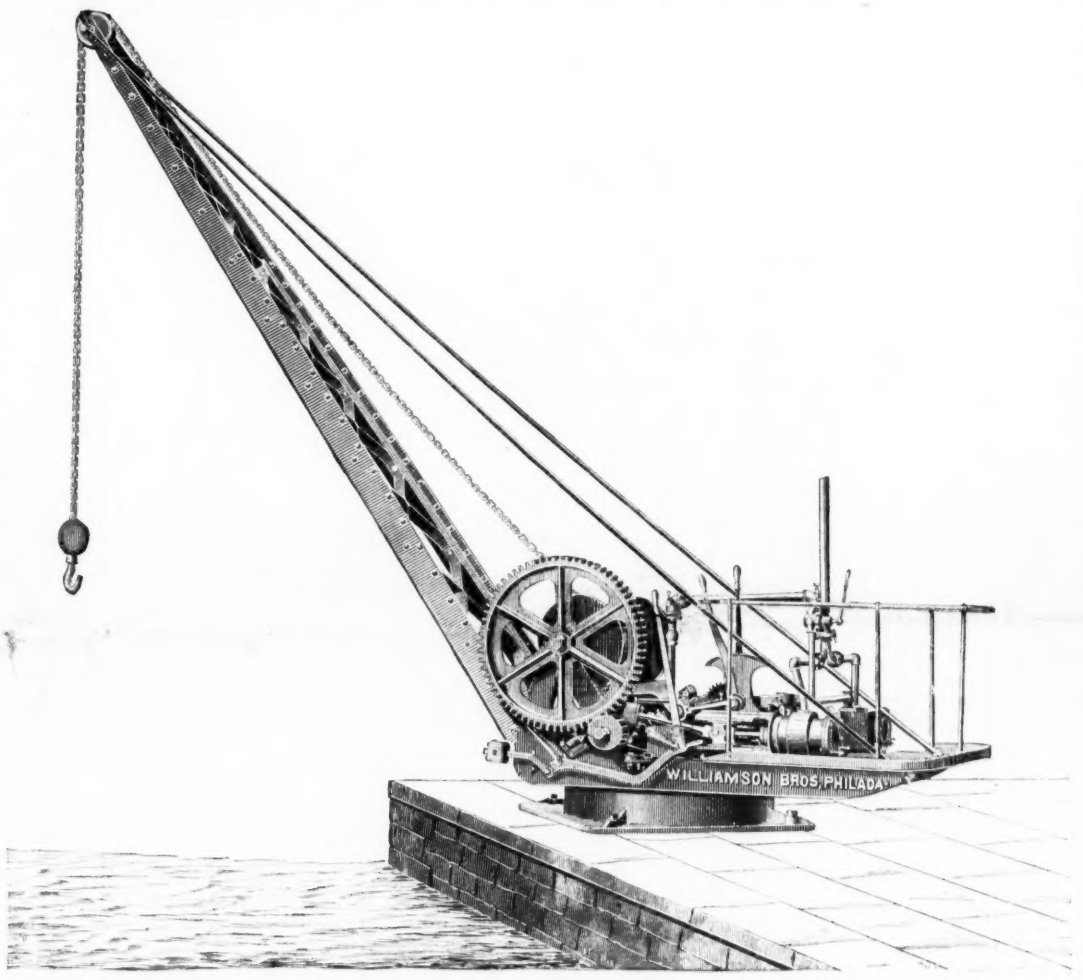
The portable hoisting engine is more particularly designed for stevedores and contractors. It is conveniently moved from place to place by one horse.

The axles are of steel, and the wheels of large size, which make it easy to move on any ordinary road.

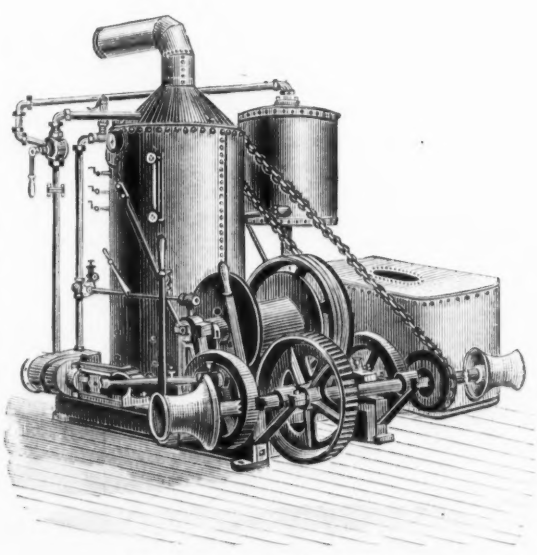
The boiler is well made, the door frame and bottom being of boiler plate.

The engine is fitted with cone friction drum; the boiler is complete with all fixtures (including lifting injector) ready for steam.

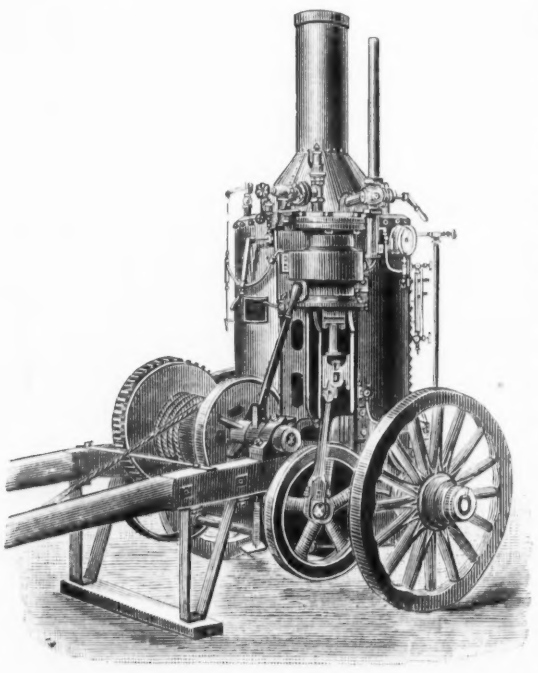
The friction drum referred to is loose on the shaft, and has at one end a conical friction part made to fit to its counterpart in spur wheel. A spiral sleeve operated by hand lever engages the friction, which is released by a spring when the lever is thrown back. A strap brake is used to control the motion of the drum in lowering.



STEAM REVOLVING WHARF CRANE.



SHIP HOIST, WITH CONDENSER.



PORTABLE HOIST.

Notwithstanding the depression in business, the traffic of the Pennsylvania Railroad, it is said, was never larger than it is at present. We hope this is true, but think it open to some question.

Friction Pulleys—Grinding Tools—Cutting Tools.

BY S. W. GOODYEAR.

If I am right in supposing that it is a free fight in which Mr. Hobart and Mr. Richards are engaged, I would like to take a hand. It has been extremely interesting to me to read the criticisms of well known methods. The slurs upon the good judgment of those who had got over the old notions that steel was ruined by upsetting, and that all friction clutches were simply delusions and snares, and that in thread-cutting tools the tearing of threads was altogether due to the point of the tool being too high; and about grinding, that it made so much difference after all whether a tool was ground on the front or back of the stone, or, in fact, on the top or bottom; had led me to look forward to a new dispensation on these subjects which should go to the real pith of the whole matter as thoroughly as in the matter of driving arbors into and out of holes. But, perhaps, there is more to come; perhaps this funny man of the AMERICAN MACHINIST is waiting for somebody to get caught in his cunningly baited trap. He is immensely entertaining. Even those who know little or nothing about the subjects of which he writes will read, and feel interested. His description of the sorrows of a poor man up a ladder nearly all the time for months in vain efforts to coax, drive, oil, or otherwise induce a friction clutch to properly drive a lathe, and who finally became supremely happy (machinist-wise) by having the clutch relegated to the scrap-heap, and a fast and loose pulley put in its place, would be very interesting and instructive, if it were not a fact that such clutches properly made and adjusted, with intelligent treatment, are running by the thousand, and giving less trouble in an entire year than the same number of fast and loose pulleys would give—as usually fitted, and treated—in a single week.

Do I know anything about friction clutches? I do. I know that I once fitted up a room with a class of machinery which it was desirable to run on tables, in sets of four to six machines on a table. For all the machines on a table a single countershaft was used, on which was a friction clutch and driving pulley for each machine. With the hundred or more friction clutches in that room, running ten hours per day, there was so little trouble that ground could not have been found in a month for the troublesome ladder-raising experience of a single day of the man who could not make a friction clutch work. With clutches that never miss fire, and self-oiling countershafts which need oiling but twice a year, what is the use of trying to palm off upon a confiding general public the fast and loose pulleys as better? They have their uses, and for many places are better than clutches.

And, about grinding. Why, who don't know that in machine shops in general, tools are ground in front of, and behind the stone,

and all the way up to the top from each way? Boys who perhaps don't know better, and men who are old enough to know better, if they are ever going to learn, will stand at the back of the stone to grind, and won't use a rest either, and some of them grind tools well too. *How* the tool *is* after grinding, rather than *where* a man stood to grind it, is the question. Some men always grind a tool well, and would, if they had to lie on their backs under the stone, and will stand anywhere to grind where they can reach the stone. Other men never grind a tool well. Many tools are ground with too much clearance, thereby necessitating a too obtuse cutting angle, and making a scraping tool of what should cut. Many tools are snubbed off in grinding both in clearance and cutting angles with the false notion, that because at the first or second grinding it can be done more quickly it is the thing to do. It is all wrong. Having fixed upon the proper angle at top and for clearance, whenever a tool is ground keep to the same line. It is the cheapest in the end, makes less grinding in the aggregate in the life of a tool and calls for less frequent redressing.

About the tearing of steel in threading: Is it true that the shape of tool, or how it is set, or whether the clearance has been calculated with mathematical precision, to have the same lean-to that is to be found in the thread, is at the bottom of the trouble?

That most machinists have been at times troubled with tearing of steel in threading, is true. Is it not true that sometimes no change in shape or adjustment of tool will overcome this very provoking difficulty? If, when all known methods have been resorted to, with the result of having every thread in the length of a screw badly torn, the screw should, by reannealing, be put in condition to be cut as smooth as glass with the tool set just as it had been when it tore so badly, what shall we say then? Condition of steel has a say here.

Mr. Richards seems to know how to grind, and he *cuts*, too, clear to the bone. When he talks, he always has something to say. He was not fooled much with that twist drill dodge. Humph! A twist drill the ideal of a cutting tool, with its dead center to tear, wear and maul out the stock, or alongside of a properly forged, properly ground, properly-adjusted lathe tool, which cuts from the very point back to the periphery of what it is working on! If Mr. Richards ever gets the promised "photo" of that "post," he should reciprocate by sending to the donor a lathe tool chip such as come from turning a shaft of a foot or more in diameter, in the hope that with such tangible evidence—why, such chips roll off wide enough and thick enough to make horse-shoes without even "upsetting"—the recipient may be able to see the difference between turning chips and the cuttings from twist drills.

By the way, speaking of twist drills, I am acquainted with an inventor who conceived the idea that twist drills, as made, with concave lips were possessed of certain innate cussedness, such as a tendency to draw in in soft metal, causing them to catch and break, especially in passing through at the finish of a hole which was drilled clear through, and that the concave lip had the effect of bringing the cut for a large portion of the cutting edge in a direction which did not give the drawing stroke, which is found so serviceable in cutting instruments in general. As an improvement upon the ordinary twist drill, this inventor made and patented a twist drill and machinery for its manufacture, the peculiarity of which consisted in the cutting lips being convex instead of concave, the advantages claimed for this drill being that with that part of the lip nearest the center going in advance, there is a drawing stroke for the entire length of the lip, and a tendency to carry off the stock at the center of the hole more readily from the direction of cut forcing the chip to the outside of the hole and away from the center, rather than clawing it in toward the center, as the concave lip is supposed to do; and, further, this drill won't draw in like the common drill, and, when used in an upright, with so much back-lash that the spindle drops toward a quarter of an inch as the drill passes through a piece, there is less danger of breakage, and, even if the spindle is running snugly, as it should, it is a fact that almost any of the boys will forget, and let the drill run through suddenly. Just here is where the convex lip drill is supposed to show a very great advantage over either concave or straight-lip twist drills.

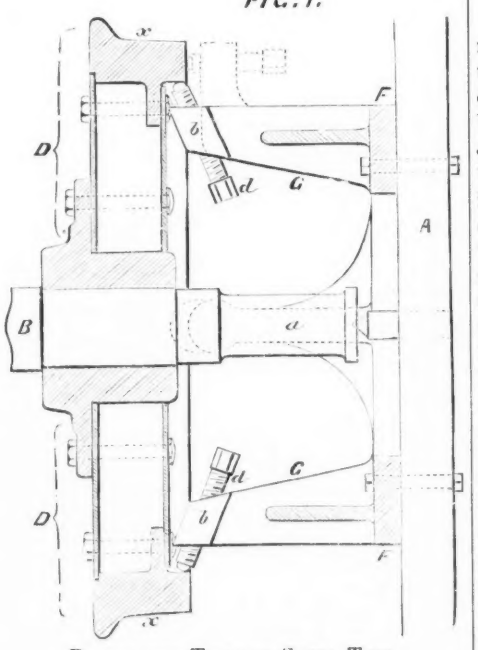
About grindstones again. I have seen several times, of late, that there is an evident intention on the part of the ubiquitous emery or corundum wheel to push the old-fashioned grindstone out of use as a tool-grinder. These whee.s are rigged in a frame provided with a pump for carrying water on the wheel, and a rest is provided for the front of the stone while the top and back of the stone are covered. This rig must suit Mr. Richards to a shaving. And there is another kind, in which a rest is provided for front and back of wheel, too; so Mr. Hobart can have his grind, his way. Ugh! it makes a fellow think of the time when, as a boy, he tried to stand on his head. These emery tool-grinders are actually put right in the middle of the shop, too, some of them occupying room which could not be wasted in that way a few years ago. I have seen one of them this very day in a shop where I used to work more than thirty years ago. How did we grind then? On a grindstone some 7″ to 8″ thick, which, when first mounted in its wooden frame, was some 5′ or more in diameter. The stone stood in a little room at the extreme end of the shop, into which room the light was admitted through a single window at the front of the stone and by the doorway. The window was directly back of the man who ground correctly, according to Mr. Richards, and the use of the upward stroke of the stone, according to Mr. Hobart, was unknown in those heathenish days. Besides a truing device, consisting of a cylindrical revolving serrated contrivance, was in the way of a rest at the back of the stone, and the window soon became smeared with mud from the grindstone. The main reliance for light was through the doorway, which, as there was a dead wall on one side of the shop, and on the other side the windows opened into the foundry, added to the fact that sometimes two or three men stood in or about the doorway waiting for a chance, with frequently two or three grinding at once (for the men who ground on the top of the stone, and all the way along down to that truing device, were there), shed just sufficient light to keep the grinder in a blissful state of uncertainty as to whether he had accomplished what he undertook, until he had traveled back to his lathe or planer, or to where he was engaged in chipping and filing. The rest on the wooden frame was a board a foot wide; sometimes a piece of iron or steel lay on this board. Some men could strike the angle at which they wanted to grind a face, and holding the tool on this rest, were never known to fail in bringing a clean, cutting edge out of the worst shape in which the tool-dresser could leave a tool, or the most outlandishly snubbed condition in which the worst snubber in the shop could put any tool which he ground. Other men would never strike the right angle, and, through shifting the position of the tool, would have as many different angles in what they intended for one clean face as the tool had been held in different positions, and they would have the tool catch and skin their knuckles, and tear great pieces out of the face of the stone, and so the stone would be all full of ridges and humps, with great creases cut into its face so deep that to turn them out would reduce the diameter of the stone an inch or more.

About grinding on the corners of the stone to carry the point of a thread tool down, according to Mr. Hobart. Why, Mr. H.! Why, you would have to grind back on to the body of the tool more than an inch! Why, the corners of that stone represent all the curves to be got from changeable radius of anywhere from an inch to two feet, and one good raking from the tool of some irate grinder, who had got tired of grinding the clearance faces of a tool to get to a point, and went for the corner of the stone Hobartwise, with clenched teeth, would at any time change the daintiest quarter-circle corner on a radius of $\frac{1}{4}$″ into—goodness knows what! Why, the concave ground in the top edge of that tool would increase in radius and width with all the changeableness of a crevasse in a levee under the influence of a heavy rise. Corner on a grindstone! Humph! It won't keep in shape under use for the most infinitesimal part of a second. Grind anything twice alike? No, nor once either; for what you have will depend wholly and entirely upon when you stop grinding.

Emery or corundum wheels of proper quality can be used to grind curves to advantage. May the day come when no machinist will be called upon to stand in grindstone mud of varying depth, from the thickness of his boot sole up to ankle deep, to grind his tools in the darkest corner of the shop, but may be permitted to stand on a dry floor, in as good light as can be found in the shop, and grind on an emery grinder, whose pump attachment keeps the wheel always wet, *while running,* instead of calling for or splashing water on with a stick, or leaving one side of stone or wheel to stand immersed in water when not running until ruined. Grindstones have their uses, like fast and loose pulleys, but there are places where an emery wheel one foot in diameter by two inches thick, will accomplish more than a grindstone of three times that diameter and thickness. I verily believe that I have seen such an emery wheel bring about a saving of $150 per year on the work of one man in a manufacturing direction. What, then, may it not accomplish as a tool grinder in the hands of a shop full of men?

And about tools in general. How is it that some men always grind and set and use tools to cut, while others always scrape and dig? Look at a wood turner who, elevating the keen cutting edge of gouge, or chisel, almost to the extreme angle at which there is sufficient clearance beneath for the tool to cut, sends the chips flying in very ribbons, and leaves the turned surface polished like ivory! Let, now, one of the scraping kind of men take the same tool, and see the difference. Elevating his elbows to get the cutting edge of the tool down where it won't catch—if he can, for he knows how it is—the music begins, not much like the smooth, satisfied purr from the touch of the man whose tools cut, but a succession of shocks, a sound as of ripping and tearing, which is what it really is, at a waste of power, ten times the wear upon tools, less than half the work in a given time, and such work! Neither round, smooth, nor having any of the characteristics of good turning, and only made to pass by the liberal application of sandpaper. But what has wood turning to do with a machinist's practice, anyhow? Not much, perhaps, but if the gouge and chisel can be held by expert hands, and touch as delicate as that of the fingers upon the strings of a harp, when brought to the work at an angle which would be expected to cause a lathe tool to cut in and catch, while if the same tool be held as the scraping turner would hold them, they will make the man who holds them against the strain of tearing off the stock feel as though there was danger of his being lifted from the floor and projected head foremost through the ceiling. (And the difference in wear of tools! Why, between cutting and tearing off either wood or metal there is difference enough between the first cost and time spent in grinding to constitute the line between success and failure in many a business.) If, I say, there is a close relation between what gouge and chisel do in experienced, intelligently guided hands, and what lathe and planer tools and other cutting instruments may be made to do on metal, then, as the position of cutting edge, direction of strain relative to resisting force, and the force required to resist that strain when tools are properly held may be estimated so closely, why should not we, who tear and scrape the metals, learn from the wood turner how to cut?

FIG. 1.



DEVICE FOR TURNING STEEL TIRE.

Device for Turning Steel-Tired Car Wheels.

The accompanying cut represents a convenient and effective device for turning steel-tired car wheels on their axles in an ordinary double wheel lathe. It is the invention of Mr. Wm. Woodcock, M. M. Central R. R. of New Jersey, and was patented by him April 21, 1885. As will be seen from the illustration, it is designed to obviate the objections which exist when the wheel is held and driven in the ordinary manner. By this new arrangement, the wheel is held at points adjacent to the tread, so that the power is applied as nearly as possible where the cut is being taken. The device comprises a ring *F*, bolted to the face-plate *A*, and having a series of projecting arms, or brackets, *G*; the outer ends of these brackets being provided with inclined lugs *b*, threaded for the reception of screws *d*, which, when the screws are projected, bear upon the inner side of the rim of the wheel, and securely grip the same. The ends of the screws are cupped so as to present sharp edges which will bite into the metal of the wheel and insure a firm hold of the screws thereupon. If desired, the arms *G* may be bent at the ends for the reception of set-screws which engage with the outer side of the wheel rim, as shown by the dotted lines; or, instead of employing a ring with a series of arms, the brackets may be separate pieces and bolted independently to the face-plate *A*.

By arrangement with Mr. Woodcock, this device is manufactured by Bement, Miles & Co., Philadelphia, Pa.

The manufacture of steel nails has made rapid progress since 1883, in which year this industry may be said to have had its beginning. During last year there were 393,482 kegs of steel nails manufactured, the production of the three leading nail-making States being as follows: West Virginia, 204,336 kegs; Ohio, 130,636 kegs, and Pennsylvania, 29,324 kegs. In 1883 this country produced only 18,224 kegs of steel nails.—*Mining Herald and Colliery Engineer.*

One by one, steam power displaces hand power processes. The latest invention is a steam dredge for gathering the oyster crop. The old-time manipulators of the rake declare the thing will not do, but the inventor is sanguine that he will work a revolution in the oyster trade.

The Bulletin of the American Iron and Steel Association says:

"Constructing engineers report themselves in receipt of many inquiries from manufacturers who desire to add steel works to their iron plants. If all, or even a reasonable part of, the projects in this direction are carried into execution an enormous in-

crease in the steel-making capacity of the country will be effected before the close of this year. * * * * * * * *

"The steel question in the East is on a different footing from that in the West. Here it appears to be a question of quality of product rather than of cheapening the cost of manufacture. Iron can still be worked in this section at a lower rate than that at which steel can be converted, owing to the lower wages paid to rolling-mill employes in the East as compared with those paid in the West, where steel is produced more cheaply than iron in certain lines of products. Hence the tendency to add steel plants to Eastern iron works is thus far not specially remarkable."

The Blaisdell Improved Upright Drill.

The upright drill illustrated on this page is one of an improved pattern made by P. Blaisdell & Co., Worcester, Mass. The "Blaisdell Upright Drill" is well known, having been one of the first quick-return drills upon the market. Our cut represents a machine which drills to the center of a 45″ circle, and is well adapted to steam engine and railroad shops. The column has been enlarged, making it 12″ diameter, to give greater stiffness, and the bevel gears are cut larger and coarser. The back gears and cones have also been made heavier. A brace has been placed in the back to increase the rigidity of the tool when doing heavy work. A strong, heavy arm supports the revolving table or drill plate, which can be swung away from the drill, leaving the plate at the bottom clear for large work. This drill, as well as all the other sizes built by the firm, is fitted with the Blaisdell device for quick return. The spindle is of cast steel, 2½″ diameter, with heavy long bearings. The Morse Twist Drill Company's taper is in the end for socket. The cone carries a 3½″ belt. The machine weighs 3,300 pounds. From base to end of spindle is 59 inches; from table to end of spindle, 41 inches.

Steel Castings for Locomotive Work.

REPORT OF A COMMITTEE OF THE RAILWAY MASTER MECHANICS' ASSOCIATION.

Your committee, to whom was referred the subject of "Steel Castings for Locomotive Work," would report that they issued, through the secretary, the following circular of enquiry to all the members of the Association:

To the Members of the American Railway Master Mechanics' Association:

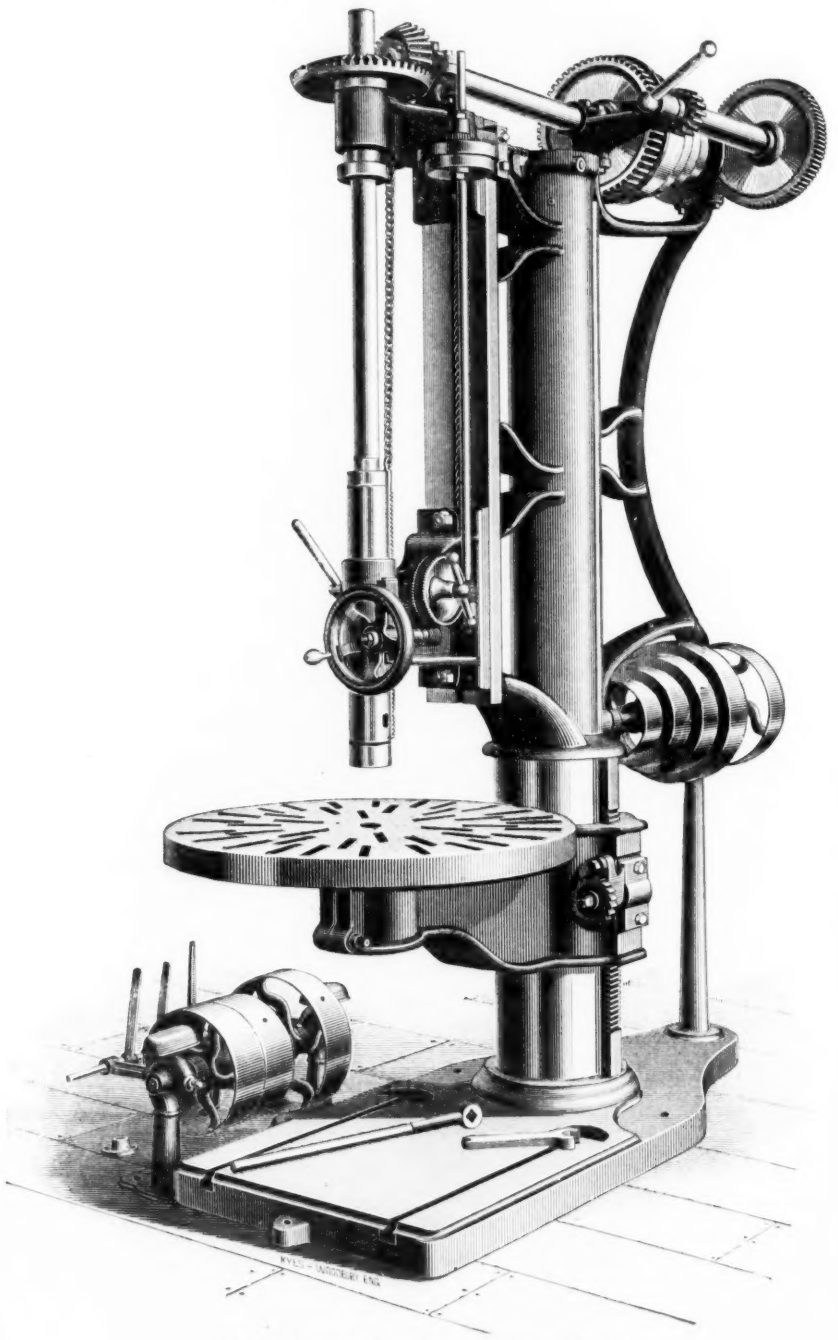
1. Have you had any experience with steel castings for locomotive work? If so, please say to what extent.
2. Do you believe that steel castings can be used satisfactorily as a substitute for iron?
3. Does your experience with steel castings lead you to believe that the material is reliable under all circumstances?
4. What parts of a locomotive do you consider steel castings best adapted for?
5. Taking into consideration the first cost of steel castings, how does the service got from them compare in cost to the service got from iron?

The committee will gladly receive any additional information on the above subject you may have to communicate.

To this circular the committee received only fifteen replies. Although the information elicited was more meager than your committee had reason to expect, it was obtained from master mechanics in all sections of the country, and may be accepted as representing fairly the experience of the members with steel castings for locomotive work. Several of those who sent in replies had very limited experience with crucible steel, but the general impression was that for the purposes to which they have been applied, castings of this material are much more reliable than cast iron, and not so reliable as wrought iron. To this conclusion there was one decided exception, one member having expressed the opinion that steel castings were preferable to cast or wrought iron for general work.

Most of the members heard from have applied steel castings for cross-heads only, and all of them with this experience reported that for that purpose the material is quite reliable. One member only has reported as using crucible steel axle boxes, one uses link hangers, one main crank pins, one eccentrics, and two rocker arms made of crucible steel.

All the members who sent in replies are agreed that steel castings are more economical than iron where they can be used advantageously. The economy of substituting steel castings for cast iron arises from the superior strength and durability of the former over the latter; while the benefit of using steel castings to replace wrought iron is gained in saving the labor of making forgings. As steel castings can be put exactly into the forms required, a great deal of machine works is often avoided by their application to locomotive work.



THE BLAISDELL IMPROVED UPRIGHT DRILL.

In replying to the circular Mr. J. Davis Barnett displayed an intimate and wide acquaintance with the subject of crucible steel castings and your committee quote the following from his reply:

"They (steel castings) are being substituted in marine work very rapidly and with success. Where it is an object to save weight—as it is more particularly in the reciprocating parts—and yet retain strength they should be used."

Answering query 3 he says: "Yes, if crucible steel is used and its price is paid; for, as Emerson said, 'cinder in the iron, often means cinder in the price,' and so fine a material must be paid a good price for; but the increased demand will soon lower the price. A German firm this year have been delivering crucible castings, sound, well finished and very free from blow holes at the same price as castings by local firms using the cheaper and less reliable processes of Bessemer & Siemens cost, by the ton, being about 4½ cents per pound, or perhaps 5 cents for small work; whereas on this continent, I doubt if satisfactory contracts have yet been made much under 7½ cents per pound, and I think 9 or 10 cents has been asked.

"Steel castings will yet be used for connecting-rods and piston-heads, thus lessening the weight of the reciprocating parts requiring to be balanced, and permitting length of cylinder to be shortened. Mr. Webb of the London & North Western Railway is now casting Bessemer driving wheels in a revolving mould, thus condensing the metal; but the rim and spoke are fashioned after the style of the forged wrought iron wheel, that is, they are solid, whereas, less metal for the same strength could be obtained if the American hollow system were followed. The hollow column is nature's system, and she is chary in the use of material, as the examination of a limb, bone, or a length of wheat stalk will show.

"The rocker and reversing shaft should be cast hollow, keeping them at about their present diameter, the arms being ribbed. Eccentric sheaves, straps, and rods, with link block and all its connections, may be of steel, with advantage to their weight; and in the substitution of castings for smiths' work in such small things as bell cranks, throttle lever, door and injector fittings, as well as rocker and reversing shafts, the first cost of manufacture as well as of machine work will be lessened, as fewer surfaces will need machining, and those few require less metal to be removed from them."

Your committee are aware that when steel castings were first introduced into general machine work, they were not found reliable in numerous cases, and many parties abandoned their use after trial. We have reason to believe that the failures were due to a great extent to the inferior work produced in the first stages of a new industry, and that many who abandoned steel castings after the first trial have returned to using them, with satisfactory results. In many departments of machine work throughout the country, steel castings are being rapidly substituted for expensive forgings. We see no reason why this material should not be applied to all the details of locomotive work recommended by Mr. Barnett; but we think it might be applied to the making of cylinders, driving wheels, and other parts, where increased strength would mean increased durability.

The high price of good steel castings is at present an obstacle to their adoption for ordinary purposes; but we believe the law of competition is working to reduce this price, and that it will soon be cheaper, all things considered, to use crucible steel than to use cast iron for many purposes about locomotive work.

There have appeared in some of the leading mechanical papers, lately, articles describing the making of steel castings from old rails and other steel scrap, by a process where a common cupola was used to do the melting. Most of the members have probably read the articles. Your committee have received no direct information about this new process of making steel castings, but they think the process might prove of great value to railroad companies, and that it deserves investigation by the members of this Association.

R. W. BUSHNELL,
JOHN H. BLACK,
T. J. HATSWELL,
Committee.

The Master Car Builders' Convention.

At the recent meeting of the Master Car Builders, a committee reported a standard form for the treads and flanges of wheels, the standard distance between backs of flanges being fixed at 4 feet 5⅜ inches, with ⅛″ allowance either way. Mr. Forney, one of the committee, while acquiescing in the report, making radius of flange corner ⅜″, favored ½ inch, instead of ⅝ inch. The report fixes 1⅛ inch, as the standard depth of flange, and recommends a cylindrical tread of 2 inches, the remaining 1⅝″ width of tread being beveled $\frac{3}{16}$″ on a side.

The standard diameter of the cylindrical part of chill moulds was fixed at 30⅜ inches for 30-inch wheels, and 33½ inches for 33-inch wheels. Width of flange including corner, 1⅜″, making total width of tread and flange 5½ inches.

In the discussion Mr. Kirby said that the true cause of sharp flanges, both in steel-tired and cast-iron wheels, was extra soft wheels, or badly matched diameters.

Mr. Barr thought 1″ depth of flange was sufficient, and favored a radius of ¾″ in the angle of flange, as better than ⅝″. Many members favored a slight coning on the tread. The report will be voted upon by letter-ballot.

Another committee recommended dimensions for a standard freight car to carry 60,000 lbs.

The perennial car-coupler question was referred to the Executive Committee with instructions to ask aid from railroads in making the tests needed for definite action. The convention will meet next year in Boston.

We notice some machine shops that are well supplied with tools for general machine shop work, but which during the flush times went into special work are again turning their attention to general work, and with good results so far as amount of business done is concerned. There is always more or less opening for heavy contract work of this character; and in these times shops prepared to handle it expeditiously may find more money in it than in specialties. A first class machine shop, prepared to submit bids on heavy machinery not in the line of manufactured articles, can usually find opportunities to do so.

Mr. J. Davis Barnett, of Port Hope, Can., was elected President of the American Railway Master Mechanics' Association last week, and Mr. J. H. Setchel was re-elected Secretary. The next Convention will be held at Boston.

Modern Locomotive Construction.

BY J. G. A. MEYER.

SECOND PAPER.

We may divide the different kinds of locomotives into two distinct classes; in one class we may place the ordinary passenger and freight locomotive, and in the other the switching engine and other locomotives designed for some special service.

At present we will consider only the first class, namely, the passenger and freight locomotives. These engines are again divided into four different classes, namely: 1st, the eight-wheeled engine; 2d, the Mogul engine; 3d, the ten-wheeled engine; 4th, the consolidation engine.

An eight-wheeled engine, sometimes called the American locomotive, because this design was first brought out in this country and used here more than elsewhere, is an engine that has four driving wheels and four truck wheels, as shown in Fig. 1. On some roads the eight-wheeled engine is used for both passenger and freight service, but generally it is recognized as the passenger engine. A Mogul engine is an engine that has six driving wheels and two truck wheels, as shown in Fig. 2. These engines are mostly used for freight service; occasionally they are used for passenger service, but generally they are recognized as freight engines.

A ten-wheeled engine is one that has six driving wheels and four truck wheels, as shown in Fig. 3. Ten-wheeled engines are used for fast freight service, or for hauling heavy passenger trains, or for a mixed traffic.

A consolidation engine is an engine that has eight driving wheels and two truck wheels, as shown in Fig. 4. These engines are used for heavy freight service on roads having steep grades.

Now, notice the eight-wheeled engine and the Mogul engine, each having eight wheels. In the passenger engine four wheels of the whole number are driving wheels, and in the Mogul engine six wheels of the whole number are driving wheels.

Again, notice the ten-wheeled engine and the consolidation engine, each having ten wheels. In the ten-wheeled engine six wheels of the whole number are driving wheels, and in the consolidation eight wheels of the whole number are driving wheels.

The rigid wheel base of any engine is the distance from the center of rear to the center of the front driving wheel, plainly shown in figures. The total wheel base of any engine is the whole distance from the center of the rear driving wheel to the center of the front truck wheel, also plainly shown in the figures.

Before we can decide what type of a locomotive to adopt, and before we can determine the dimensions of this engine, we must know the following particulars: 1st, the total weight of the train — that is, the combined weight of the load and cars; 2d, the speed of train; 3d, the grades and curves of the road on which the engine is to run; 4th, gauge of track—that is, the exact distance between the rails; 5th, the weight on the drivers that the rails of the road can bear; 6th, kind of fuel to be used; 7th, kind and height of couplings of cars; 8th, limitations, if any, in width, height, length, etc., by tunnels, overhead bridges, turn-tables, etc.

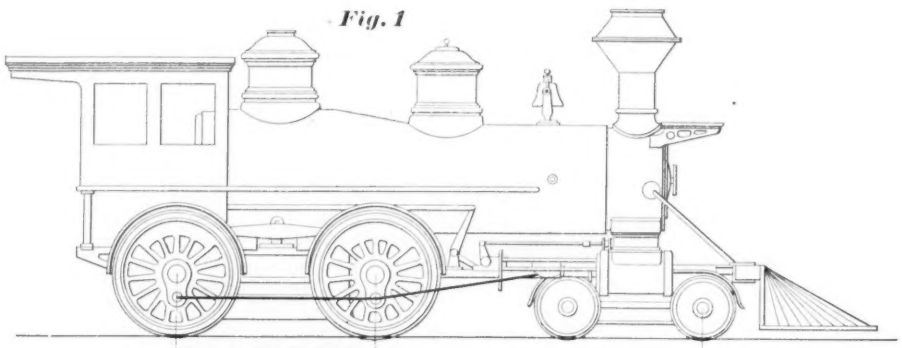
For the sake of simplicity, let us first find the type and the dimensions of a locomotive capable of hauling a train of given weight on a straight and level track, leaving the speed and all other particulars out of the question.

TRAIN RESISTANCE.

The resistance which a locomotive must overcome in slowly hauling a train over a straight and level road, is rolling and axle friction. Hence the resistance to motion of a train, or the train resistance, is simply rolling and axle friction combined. But it must be remembered that when a train is to run fast, or against strong winds, other forces must be overcome.

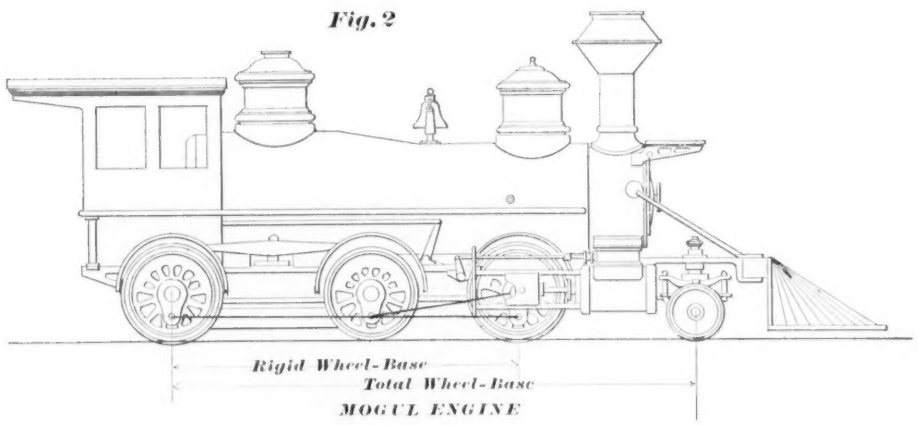
By rolling friction is meant the resistance to motion that takes place where the circumference of the car wheel comes in contact with the rail. Axle friction is the resistance to motion that takes place between the axle journal and its bearing.

Fig. 1



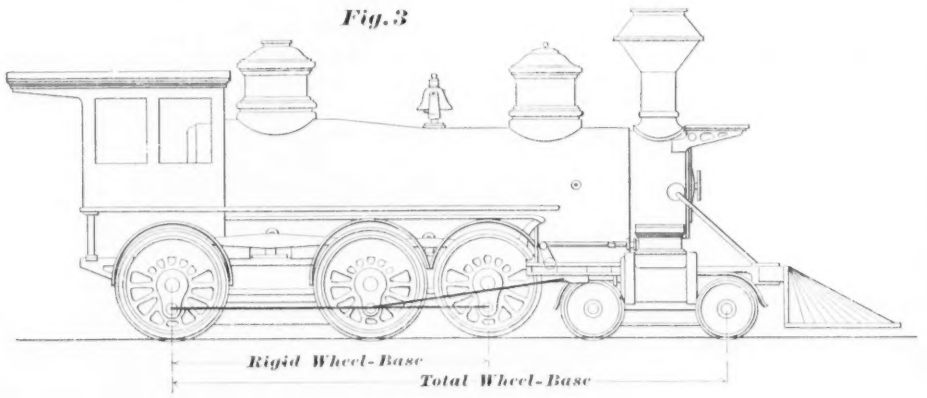
EIGHT-WHEELED ENGINE

Fig. 2



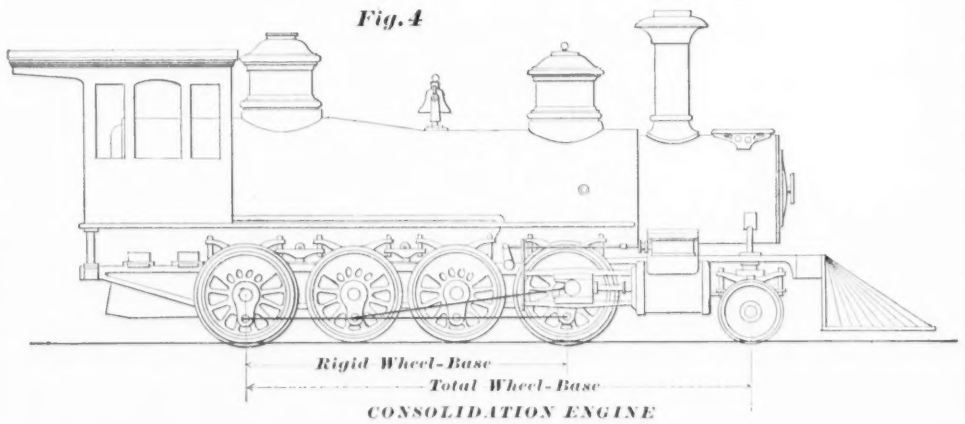
MOGUL ENGINE

Fig. 3



TEN-WHEELED ENGINE

Fig. 4



CONSOLIDATION ENGINE

An ordinary train, composed of cars whose wheels are about from 28 inches to 32 inches in diameter, and having journals about from 3 inches to 3¼ inches in diameter, will require a force of 7½ pounds for every ton of 2,000 pounds to move it. Thus, for instance, if the total weight of the cars and the load is 1,000 tons, we have 1,000 × 7½ = 7,500 pounds; this means that a train of 1,000 tons requires a force of 7,500 pounds to move it, or, in other words, it requires a force of 7,500 pounds to overcome the combined rolling and axle friction.

On some roads it may require only 6 pounds for every ton, and on other roads it may require 9 pounds to move a ton weight. This difference is caused by the degree of smoothness and irregularities of the rails, the different proportions of the wheels and journals, the kind of springs under the cars, the kind and quantity of oil used, and other minor considerations. We believe that 7½ pounds per ton will be suitable for the average railroads, and this figure we shall hereafter adopt in all our calculations in which speed and the grade is not taken into account.

This combined rolling and axle friction of a train, which a locomotive must overcome, can be found by several practical methods. For instance: Assume that one end of a rope is attached to a car, and the other end, *c*, of rope passed over pulley, *b*, as shown in Fig. 5, page 2. The bearings of this pulley are supposed to be firmly fastened to the track, and the height and position of the pulley being such that portion *a b*, of the rope will be parallel to the rail; then a weight, fastened to the end, *c*, of the rope, and sufficiently heavy to move the car, and no more, will be the force in pounds necessary to move it, or, in other words, this weight will be the force necessary to overcome the combined rolling and axle friction. Hence, if the weight of this car is 20 tons, we may expect to find that a weight from 120 to 180 pounds will move it, this difference of weight being caused by the conditions of the rail, etc., as before explained. Now, the mean between 120 and 180 is 150 pounds to move 20 tons, which is equivalent to 7½ pounds per ton.

Again, we may try another method. Instead of placing a coupling-bar between the tender and cars, let us couple these by an instrument capable of measuring a force. Such an instrument is called a dynamometer. There are different kinds of dynamometers, the simplest being a spring balance, sufficiently strong to withstand the pull, and yet elastic enough to indicate correctly the force in pounds exerted by the engine in pulling the train. Although the spring balance is not always the best instrument to use for this purpose, and is adapted only for moderate forces, we draw attention to it because its action is familiar to the reader, and probably best understood. Now suppose a correct spring balance is placed between the tender and a train, whose weight is 1,000 tons, then, as soon as the engine commences to pull and move the train, our spring balance will show a force from 6,000 to 9,000 pounds. The mean between 6,000 and 9,000 pounds is 7,500 pounds, which is again equivalent to 7½ pounds per ton.

We may also determine by observation the force necessary to move the train. It has been found that railroad cars, with wheels and axles as before described, will begin to roll down a grade when it is as steep as from 16 to 24 feet per mile. Of course, this difference is caused by the condition of the track and other considerations before mentioned.

Let the length of the line *a c*, Fig. 6, represent a mile, and the length, *b c*, the rise of the grade, namely, 16 feet. In that branch of science called mechanics, it has been proved that the force necessary to overcome friction is as much smaller than the weight* of the cars as the length of the line *b c* is shorter than the length of the line *a c*. Now, the line *a c* represents one mile, or 5,280 feet, and the line *b c* 16 feet; dividing 5,280 feet by 16 feet, we have $\frac{5280}{16} = 330$, that is, the line *a c* is 330 times longer than the line *b c*, hence the weight of the cars will be 330 times greater than the force necessary to overcome friction. Now, there are 2,000 pounds in a ton, hence $\frac{2000}{330} = 6.06$. This means that it requires 6 pounds per ton to move the train. If we assume the grade to be 24 feet in a mile when the cars begin to roll down the grade, then the line *b c*, Fig. 6, will be 24 feet long, and $\frac{5280}{24} = 220$, that is, the line *a c* is 220 times longer than the line *b c*, therefore $\frac{2000}{220} = 9$ pounds per ton to move the train, or to overcome rolling and axle friction; the mean between 6 and 9 pounds is 7½ pounds, as before.

From this we may establish a rule for finding the force necessary to overcome the train resistance, the speed not being taken into consideration.

Rule 1: Multiply the weight of the train in tons (of 2,000 pounds) by 7½; the answer will be the force in pounds necessary to overcome the train resistance. If to this we add the resistance of the tender and its load, also the force necessary to move the engine itself, we then know the energy an engine must exert to haul a train.

For all practical purposes we may assume that 7½ lbs. per ton is not only sufficient to move the train, but also includes the force

* Instead of using the word "weight," we should have said "pressure," because the weight and pressure are equal only on a level track, and not on a grade; but in this particular case, the difference being so small, we have, for the sake of simplicity, used the word "weight." How to find this difference will be explained hereafter.

necessary to move the engine and overcome the friction of its machinery, hence no separate calculation for this is necessary.

The resistance of the tender is found by rule 1, that is, multiply the weight in tons of the tender and its load by 7½, and the answer will be the force in pounds required to overcome this resistance. Or, still simpler, add the weight of the tender to the weight of the cars and multiply the sum by 7½. Thus: Ex. 1: The weight of a train is 1200 tons, and the weight of the tender 20 tons; find the force in pounds necessary to haul this train; 1,200+20=1,220 tons, 1,220×7½=8,150 pounds, hence the engine must be capable of exerting a pulling force of 8,150 pounds.

ADHESION.

The effort to haul a train which a locomotive can exert is limited by the adhesion between the driving wheels and the rails. This adhesion is simply friction between the driving wheels and rails acting so as to prevent slipping. If, for instance, the train resistance exceeds the adhesion, the driving wheels will slip, or in other words, turn round without advancing.

The adhesion depends upon the weight placed on the drivers. When the rails are dry and in comparatively good condition we may assume that the adhesive force is equal to ⅕ of the weight on the drivers. Thus, for instance, if the weight on the drivers is 40,000 pounds the adhesive force will be 8,000 pounds. This adhesive force enables an engine to pull a train, and must not be less than the train resistance. When the rails are wet, muddy or greasy, this adhesive force will be considerably less, and snowy or frosty weather will also reduce the adhesion.

In the following calculations we shall consider the track to be in good condition, and therefore shall assume the adhesion to be equal to ⅕ of the weight on the drivers. If the condition of the track is not known, the writer believes that the adoption of ⅙ of the weight on the drivers for the adhesion will not lead to disappointment as often as when ⅕ is adopted.

WEIGHT ON DRIVERS—NUMBER OF DRIV NG WHEELS.

From the foregoing remarks we have learned that when the weight of the train and tender is known we can find the train resistance; also, that the adhesion must at least be equal to the train resistance, and since the adhesion is equal to ⅕ of the weight on the driving wheels, we multiply the train resistance or the adhesion by 5, the answer will be the total weight on all the drivers.

Ex. 2. In example 1 we found the train resistance to be 8,150 pounds, what must be the total weight on the driving wheels? 8,150×5=40,750 pounds, hence the total weight in all the drivers will be 40,750 pounds.

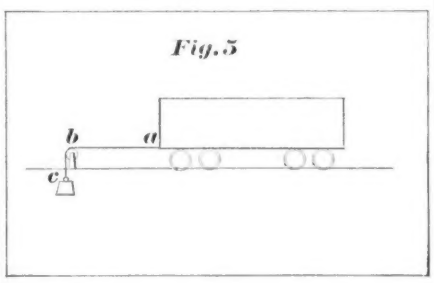
On some roads heavy rails are used, on other roads lighter rails are adopted. The heavy rails can, of course, bear a greater weight on the drivers than the lighter rails, therefore, before we can find the number of drivers under an engine, we must know the weight that the rails can bear.

Messrs. Tannett, Walker & Co., of Leeds, England, have completed and are about to put under steam in their own works a gigantic pair of compound engines for rolling steel rails, girders, and other sections at Bilboa, Spain. The two high-pressure cylinders are each 42″ diameter, and the two low-pressure cylinders are 60″ diameter, all of them having a 5-foot stroke. The crank-shaft of steel is 22″ diameter, and the total weight of the engines is 530 tons.—*Machinery Market.*

Senator Platt, of Connecticut, in a recent speech to a club in New Haven, said:

When a man projects a railroad which he never intends to operate; builds it by money borrowed through the inspiration of false confidence, capitalizes it for three times its cost, and makes a million of dollars without the expenditure of a dollar of his own money, and with no effort but that put forth to delude people into purchasing his doubtful bonds and worthless stock, it is too much to expect of a man who has for a year's honest work received only a thousand dollars, not to feel that in some way he has been personally wronged. He will not feel that the property of the millionaire thus obtained is as sacred as his own moderate savings. But, disregard of the property rights of one man insensibly begets disregard of all property rights, and under such circumstances it is easy to inflame the minds of the poor against the rich, and there are plenty to extend and to heighten the inflammation, so that gradually labor becomes hostile to capital, and ascribes to all who possess property a contempt for the rights of honest toil. The picture is not overdrawn. And the many instances of fortunes gained by methods to which the common public gives the name of swindling and gambling have done very much to intensify the discontent of labor of which I have spoken. Such men are in no sense workers. It ought never to have been possible to accumulate property by such

Fig. 5



methods. If it were possible to devise laws to prohibit and punish such "operations" the indirect benefit to labor would be immense—for whoever is allowed to obtain money for which no fair equivalent is rendered deprives labor of its just share of wealth. It may be difficult to define with precision what methods are proper, and what improper, in the acquisition of money. Equitable principles are not easily framed into statutes, but there has been far too little attempt to make the application, and society is beginning to feel, and painfully feel, the lack of such legislation.

LETTERS FROM PRACTICAL MEN.

Giving Information on Mechanical Matters—Casting Rolls.

Editor American Machinist:

I confess I feel very highly complimented at the fair, impartial manner in which the Eufaula Boiler Explosion, Cutting Down the Face of Gear Wheels in the Mould, Melting Steel in an Ordinary Cupola, Casting Rolls with a Wrought Shaft in Them, and other of my articles have been discussed. I am sure the discussions have been a source of profit in the way of information to me and other readers of the AMERICAN MACHINIST.

Who among your readers has not met inordinately selfish men; men who seem to be wrapped up in the conceited idea that all the knowledge they possess is original with them, and no one has a right to share in it. They forget that they are under obligations to some one for instruction and information when learning their trade.

I do not wish it to be understood that I think because a man does not write his experience for the benefit of others that he is selfish on that point. I know a gentleman who is prominent in the foundry business, and well posted in foundry practice, and he is willing at all times to give anyone the benefit of his experience. He tells me he cannot write and express himself so as to be rightly understood. There are many like him who are liberal with the knowledge they possess, yet feel they have not the ability to convey their ideas to others through the medium of the press. This is no doubt true.

On the subject of casting rolls, I believe the best plan that can be practiced is the process of tinning the shaft described by David Spence in May 30 issue, which is practically the same as Mr. Jewett recommended to F. H. V. in "Questions and Answers." My only objection to that plan was, that where they do not make a practice of making that class of work, it is not convenient for the average foundryman to employ it; therefore I recommended red lead mixed with turpentine as a quicker and cheaper method. If Mr. Hoadley will read my article carefully he will find I employed the word "paint" to indicate the manner in which it was applied. Mr. Chanic has said all I intended to say to Mr. Hetherington on "Foreign Substance," "The Union of the Metals," etc., etc.

I described three classes of work to contain wrought-iron bars. One of them was castings of ½-pound weight, to contain ¼″ rods cast firmly in them. By the method given in this journal May 9 we could cast four of these in a flask, with a chunky piece of some kind in with them, and a moulder could put up 30 or 35 moulds a day. Now, a ¼″ rod will not stay hot all summer in a green sand mould. I imagine friend Hetherington would have to get around rather lively if he should try to heat his rods, set them, close his flasks, etc., while the blast was on, especially if it was snap flask work.

ROBERT E. MASTERS.

Steel Castings.

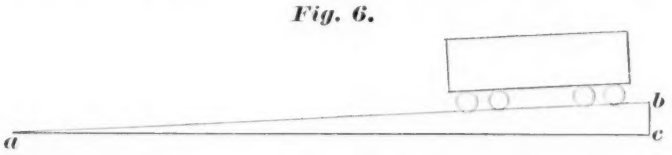
Editor American Machinist:

I have been very much interested in the communications to your paper on the melting and mixing of steel and wrought scrap in the ordinary cupola. I have used tons of both metals without any trouble as to melting, except a little heavier bedding and lighter charges. Have always got good hot metal, and found no trouble in running our light work, but it must be tapped close and handled quickly. By varying the charges, could get different qualities of castings as to hardness, but have never succeeded in getting by melting in a cupola a good, even metal suitable for working. Always hard spots would come to light, which the tool refused to touch; but by churning clean wrought iron turnings into the full ladle, I have got a very strong, tough and durable metal. In my opinion, steel or wrought scrap mixed with cast iron makes, for the ordinary rough casting, such as railroad work, a much stronger casting than those from all cast iron, and for such work it will give more service. There is no question in my mind but that, with the common methods now used of melting and moulding, the great majority of castings could be reduced about one-half in weight, and better service obtained from them, particularly so in car wheels, as the ordinary sand mould would fill the bill, and wheels would be without check or crack; now, fully one-third in some cases are worthless. There is certainly a great field open in this direction.

FRANK KAVANAUGH.

G. H. & S. A. R. R. Shops, Harrisburg, Tex.

Fig. 6.



The Air-Pump Question—Selecting Gears for Cutting Fractional Threads.

Editor American Machinist:

Letters written by practical men and published in your valuable assistant to all classes of mechanics, are read with relish by every engineer and machinist in this section of the country. The air-brake discussion is receiving a deal of attention by all of us, and we all have our opinion. I wish to say something on that subject which expresses the thoughts of a majority in our shops.

You say, with cylinders of the same area the air cannot be compressed only to the extent of the steam pressure; in other words, 80 lbs. of steam will produce 80 lbs. of air, making the allowance for friction and considering the pump to be in good order. This, I think, is correct, and can't see why or how the air can accumulate at any greater pressure, for the simple reason that when the engineer charges his reservoir he opens and closes the check until the pressure is equalized on both sides of it. I would like some one to answer this question: With a reservoir full of air, 80 lbs. to the square inch shown on gauge, and the valve one square inch area, opening inwardly against that pressure, would 70 lbs. of weight open that valve?

Mr. Adriance asks: Now, as it is plain that the piston is still in motion * * can it be stopped instantly? Why, yes, practically. As for momentum of moving parts, the friction absorbs all of that, and more, too.

Now, as to cutting screws: Mr. Richards' ideas are perfection, but still a few are apt to get puzzled in working gears out for fractional pitches. The rule I work by is very simple and easily learned, and can in most instances be worked mentally. Several machinists work this rule, perhaps thousands.

If I wish to cut a thread, say 1⅛ to the inch, with a lead screw 4 to the inch, I reduce the 1⅛ to an improper fraction, which becomes ⅛, then transpose the numerator and denominator and it becomes ⅝. Then multiply this by the number of threads of lead screw, $\frac{5}{8} \times 4 = \frac{20}{8}$. Now multiply both numerator and denominator of this last fraction by the same number, and the numerator will be the spindle gear and the denominator the screw gear. Thus $\frac{20}{8} \times \frac{3}{3} = \frac{60}{24}$; 60 gear on spindle and 24 on screw will cut the thread.

For another example, suppose we wish to cut 3½ pitch; $3\frac{1}{2} = \frac{7}{2}$, which becomes $\frac{7}{24}$, then $\frac{7}{24} \times 4 = \frac{28}{24}$; 28 and 24 gears will cut the thread, or $\frac{28}{24} \times \frac{3}{3} = \frac{56}{48}$, and so on. These calculations can generally be made very readily.

S. J. WISDOM,
Montgomery, Ala.,
W. P. & A. R. R.

Something About Grindstones and Grinding Tools.

Editor American Machinist:

In the matter of the average grindstone, its use and misuse, I would state that the result of my observation and experience is:

First—It is too small in diameter. Second—It is too broad-faced. Third—It is not properly speeded. Fourth—It is not properly cared for. Fifth—It is not properly used.

Stones should be narrow-faced to secure a greater proportion between that which is worn from its surface by useful work, and that which is removed by the truing device. It is patent to every practical mechanic that the portion of a stone most in use is a very narrow line at each corner, and the reason for this is plain when we consider that after a tool is once properly shaped the workman will endeavor to confine his grinding to the top or cutting face of the tool, leaving the sides and clearance angles intact, if possible, and to do this, keeping in mind the desired cutting lip, he must have recourse to the corners to secure the proper inclination of the tool for that result. So, it comes about that the corners are rapidly worn rounding.

In the matter of speed, I believe it is a determinate result of experiment that the faster a stone runs the faster it does its work and the longer it remains in working shape. But they are weak, and, if run too rapidly, have an uncomfortable habit of disintegrating themselves. Water has to be used for the two-fold purpose of keeping the tools cool, and the stone clean and free from glaze, but water has a decided tendency to disassociate itself from a stone that capers around too lively. So, we are compelled to reduce the speed to the fastest possible, compatible with safety and freedom from a shower bath. Now, if all the inconsistencies that exist in modern machine shop practice, I think that the running of the average grindstone is the most pronounced, because it has not the adjunct of a variable speed to regulate the changing peripheral speed due to losses of diameter.

In regard to the choice, care and use of a stone, I would discourse as follows: The desiderata in the selection of a stone are, that it should cut fast, should not glaze, and should remain true. To secure the cutting and anti-glazing qualities—for they are associated—a stone should be close and sharp-grained, and not too firmly cemented or hard. It must be just soft enough to slowly abrade under the mark; such abrasion constantly brings new cutting points into prominence, and prevents the lodgment of the abraded particles of steel upon the stone,

which would finally result in glazing. For the proper maintenance of its truth, it is essential that the stone be homogeneous, as uneven hardness *must* result in uneven wear. The condition of homogeneity is one that cannot exist in a natural stone, but ought reasonably to be expected in an artificial one, and I believe that the grindstone of the future will be manufactured—not quarried.

To get the best results from a stone filling the above requirements, it should be hung in a substantial frame, properly balanced, supplied with *clean* water, never allowed to stand immersed, because that softens locally and throws it out of balance. Therefore, I say that the average stone is not properly cared for and used, because these conditions for well-being are rarely met.

For ordinary tool-grinding, I would recommend that the "front" side of the stone be used, not because better work can be done there, but because it can usually be done there faster; and that it be fitted with an adjustable narrow-edged rest, used close to the stone, and extending around the sides toward the center about two inches. Such a rest enables one to incline his tool in any possible direction, hold it firmly with adequate pressure, while running small risk of the dreaded "dig."

In all sorts of tool-grinding, my experience tells me that the cutting edge of a tool should *always* be towards the approaching side of the stone or wheel, because that is the side where the tool is the coolest—very often not showing any discoloration when the temper of the opposite or leaving side is quite destroyed. BENJ. ADRIANCE.

Brooklyn, N. Y.

Steel Castings—Cast-Iron or Wrought-Iron.

Editor American Machinist:

The numerous articles appearing in your paper upon melting Bessemer steel, scrap steel and wrought-iron, are not only instructive, but very interesting. They should be read by every one engaged in the manufacture and in the consumption of iron and steel.

In the re melting of steel and wrought-iron for casting purposes, there is nothing new or novel; they can be re-melted in any of the furnaces now in use in the foundry or rolling mills. The question is, How can it best be accomplished, and preserve the qualities of the steel and wrought-iron in the casting produced, which should be perfectly sound and free from blow-holes, and in tensile strength compare with the materials from which the castings are made?

In the production of pig iron, I claim that the different ores should be smelted in different furnaces, and then mixed in one common vessel for particular uses, instead of the ores being mixed in one furnace. Different ores yield their metals at different temperatures, and consequently every pig in the bed contains several qualities of iron in the present practice.

To produce castings of first quality, care should be practiced in the selection of the same quality of pig for the cupola. Hard and soft iron should not be charged in the one cupola, for, if you do, you will not secure the desired results. The same precautions must be exercised if it be the desire to amalgamate scrap steel and wrought-iron, as steel and cast-iron, or wrought-iron and cast-iron. I have car-wheels that, to all appearance, are as good as new now running that have been subjected to the severest service for the past sixteen years. Their composition is pig iron, old railroad iron, wrought-iron turnings, old horse-shoes and horse-shoe nails. I have never known one of these wheels to break in service. A proper furnace for such work is one in which tuyeres can be inserted above the molten mass, through which a heavy, mellow, but positive blast can be driven. Sharp air blasts are injurious to all metals.

In melting steel to run into sand moulds, the greatest difficulty experienced is in preventing the accumulation and retention of the gases in the molten metal, which accompany it, and even generate in the mould, producing what are termed porous castings. All steel castings, to a certain degree, are so effected; but, in the main, this can be prevented, first, by securing the metal properly in a pouring ladle, and, second, by having the mould in proper condition to receive it.

For the benefit of those wishing to make solid castings upon or around wrought-iron shafts, I would say, cut a groove on the surface of the shaft, the full length of the part to be occupied by the casting, $\frac{3}{8}$ inch deep, **Y**-form. After removing the oxide or the rust from the shaft, paint it with lead or lamp-black; then place the shaft in the mould **Y** to the bottom. Gate and run from under at the center. Use risers at each end. C. D.

Preventing Scale on Crosshead Pins.

Editor American Machinist:

In reply to G. E., I find no trouble from scale on the pin or tube when I wash it with core wash before placing in the mould.

G. E. STAUFFER.

Tapping Machine.

This machine is self-reversing by pressing the work against the tap, and drawing it in the opposite direction when it is finished; check nuts on the end of the spindle govern

TAPPING MACHINE.

the depth to be tapped, when the tap is not required to pass through.

The clutch is operated by gears running in opposite directions.

It is run by one belt, the cone pulley having two changes of speed.

A universal chuck holding from 0 to $\frac{1}{2}$ in. is a part of the machine.

It can be used for drilling by attaching a lever to the foot-block spindle; the clutch being held from reversing by a set-screw.

Made by Woodward & Rogers, Hartford, Conn.

In Berlin the authorities have prohibited the use of cast iron columns in dwelling houses, unless they are surrounded with wrought iron enclosing an air space. This prohibition is said to be in consequence of the failure of cast iron columns at recent fires. To the contrary, Prof. Bauschinger, as the results of experiments, concludes that cast iron columns are safer than wrought iron when both are exposed to the conditions likely to obtain in the event of conflagration.

The Society of Mechanic Arts at Worcester, Mass., has held 12 regular monthly meetings during the past year, a paper being presented each evening on some subject of general interest, each paper being afterward filed with the secretary for future reference. So many letters of encouragement have been received from influential outside parties that the young men who are carrying on this Society have the added stimulus of believing that they are setting a pattern which can be advantageously followed in many other manufacturing places. The officers for the ensuing year are: President, H. W. Wyman; Vice-President, J. R. Back; Secretary, E. H. Park; Treasurer, F. R. Ball; Membership Committee, L. F. Gordon, J. H. Mason, and E. A. Williams.

Eighteenth Convention of the American Railway Master Mechanics' Association.

The Eighteenth Annual Convention of the Railway Master Mechanics' Association held at Willard's Hotel, in Washington, last week, was well attended. About eighty members were present, and much more than that number of visitors. Forty or more ladies honored the sessions with their presence. Despite the almost tropical heat, no languor was exhibited in the proceedings.

The First Vice-President, J. D. Barnett, of Port Hope, Ont., occupied the chair. Commissioner Edmonds, of the District of Columbia, made a pleasant address of welcome at the first assembling. He referred to the Association as composed of master magicians, who were engaged in revolutionizing the conditions of human existence, and whose contests had not been for dominion over man through fields of blood, but through God-like supremacy of mind over matter. Through their instrumentalities all material things had been multiplied in usefulness, and none had been lessened. They had manfully enlarged the earth's capacity for human existence, and had banished national famines from the earth and promoted peace among men. Yet none knew better than they themselves that other victories were yet to be won, other laws to be discovered, other difficulties to be met and overcome. Their triumphs were among the highest of modern civilization. He welcomed the Association in the name of the people of Washington.

Vice-President Barnett, in his address, paid a tribute to the deceased president, John H. Flynn, and to James Cook and J. A. Durgin, who also had died within the year. He commended the work of Secretary Setchel, who had done double duty the past year. For fifteen years he has been an efficient secretary. The work of the local railway clubs was commended. Ten or twelve years ago it was necessary to emphasize the fact that the object of this Association was not trades unionism. Now the Society is well known, and its objects are understood and appreciated. The committees, he stated, had no startling departure in locomotive construction to present. Progress, however, had been made, so that the coal consumed per horse-power per hour has become, in some places, nearer 2 lbs. than 3 lbs., a result which he considered a good showing. Power of locomotives has been increased and dead weight lessened. This has been brought about by better proportioning of wearing surfaces, by more efficient lubrication, and by using better metals. The cost per horse-power has been lessened, as more power has been obtained with less metal, less water and coal, and less outlay in repairs. The objects of coming together were to discuss possibilities of the future of the locomotive in higher boiler pressures, compound cylinders, in improved valve gears giving greater freedom from back pressures, the exhaust steam injector, control of forced air supply to the fire, both above and below the grate, also in using metal free from cinder and oxide. He believed that when the Association could more definitely define the wants of its members, manufacturers would be better enabled to meet those wants. There were various forms of railroad locomotion being experimented upon which it would be well to appoint committees to examine, such as electricity, compressed air, high and low pressures, endless rope, center grip rail, and hot water. It would be well, also, to consider electric lighting and the use of electric signals.

The elaborate system of technical training adopted in railroad shops and drawing-rooms, as well as by some manufacturers, is having a good effect. By well-trained help the business can be improved, and in helping the young to fit themselves for the positions to be filled, the railroads are helping themselves.

Upon motion of Mr. Chapman (C. & O. R. R.), a committee of three was appointed to draft suitable resolutions of condolence upon the decease of President Flynn. The chair appointed Ex-President Chapman, Ex-President Lauder, and Angus Sinclair. The resolutions were feelingly discussed by Messrs. Briggs, Morrell, Lauder, Woodcock, and Chapman, who bore tribute to the high character of Mr. Flynn as a master mechanic and as a man.

A double report as secretary and treasurer was read by Mr. Setchel. There are 220 members, 13 associates, and 3 honorary members. Twenty new members were elected.

Last year a resolution was presented that the standards adopted by the Master Car Builders' Association be printed in the reports of this Association. Secretary Setchel presented a report adverse to that resolution, which was, upon motion, received.

The reports by regular committees appointed last year were read and discussed. They bear evidence of careful and laborious research. That on Boiler Construction, by Messrs. Johann, Barnett and Allen Cook being especially thorough and valuable. Want of space this week prevents our laying these excellent reports before our readers, but they will be treated in future issues.

A noteworthy feature of the convention was the discussion of impromptu questions presented by some members.

Mr. Sprague (H. K. Porter & Co.) asked: "What is the proper height to turn flanges on drivers and truck tires?"

They are rolled, usually, $1\frac{1}{4}$" high, and in turning down to $1\frac{1}{16}$" both a waste of metal and a waste of labor is experienced. They should, he thought, be made lower in the first place.

Mr. McCrum (M. R., Ft. S. & G. R. R. agreed that there is no need of such a height as that to which they are rolled.

Mr. Black (C. H. & D. R. R.) used them one inch high, and ordered them rolled to that size, which he thought high enough.

Mr. Hatswell (F. & P. M. R. R.) used flanges $1\frac{1}{16}$" high.

Mr. Lauder (Old Colony R. R.) thought this question worthy of official action. An inch high is enough, and both time and labor are wasted in turning from $1\frac{1}{4}$". He predicted that tires will be made, in time, that will need no turning at all. The Association should start out with the size they want, and adopt something as a standard to guide the manufacturers of tires. If the Association is unanimous, manufacturers will do as they wish.

Mr. Johann said an inch is all-sufficient. Higher than that is wastage. Tires ought to be rolled so there should be no necessity for turning. He had abandoned having them turned, and bought them bored to gauge on a boring mill.

Mr. Lauder thought uniform sizes of driving wheel centers ought to be adopted, to which suggestion Mr. Johann agreed, adding that both questions should be settled by the Association.

Every locomotive builder has his own size for centers, and hardly any two agree. Uniformity would secure economy. Old locomotives can wear out as they are, but new ones should have standard tires and wheels. It is practicable to make tires as uniform as wooden-ware manufacturers make buckets, so that anybody can call for a set upon short notice, and get them.

Upon motion of Mr. Sprague, a committee was appointed to gather information, and report at next convention, upon the proportions and shape of tires and wheel centers.

Mr. Swanston (J. M. & I. R. R.) said he heard that several members have gone back to iron for fire-boxes, and mentioned Mr. Bushnell as one. Mr. Bushnell (B. C. & N. R. R.) said he had not discarded steel for fire-boxes. He had only put in two or three iron fire-boxes to try them.

Mr. Briggs asked the best method of increasing the traction of engines, especially the ordinary eight-wheel engine. Mr. Setchel said that for six months he had employed on 18"x24" and 19"x24" ten-wheeled engines a device for throwing the weight of the tank upon the driving wheels of the engine. From 3,000 to 5,000 pounds were thrown from tank to engine. The device (which was Dee's patent, of West Point, Miss.,) worked well, but it was hard on springs to leave it on all the time. It answers almost entirely in place of sand. If the weight were thrown suddenly upon the engine on a weak bridge, it might do considerable damage. It does more work and at less cost than sand.

Mr. Whitney (Intercolonial R. R.) asked if there was not danger to the rail. We load our engines now as much as they will bear with safety.

Mr. Setchel explained that the weight of tank is not thrown on with a blow, but

gradually. It acts, however, with increased force when thrown on.

In answer to a suggestion by a member that the device should only be used in starting, as it increases the wear of the tire, Mr. Setchel said that the wear of tire is less when the wheels do not slip.

Mr. Lauder said that sanding the rail makes trains draw harder, especially on curves, and decidedly so if the rail is greasy. Every wheel grinds. If the traction increaser will save in this direction, it will be worth using. Even in starting from a station it would probably work better than sand.

Mr. Swanston mentioned a trial he had made with an 18″x22″ ten-wheeled engine. With the traction increaser he took a train of 18 cars up a grade 60 feet to a mile. Then he took 24 cars, and slipped the drivers; started again with 23 cars, and slipped; then started with 22 cars, and went up without slipping. He then, with light using of sand, took 23 cars up the grade.

Mr. Angus Sinclair had been familiar with many experiments with traction increasers. They had come into favor suddenly, and as suddenly dropped out again. They never held their own for any length of time. A device of that kind was tried during the first ten years of American railroad practice, and was abandoned. He had observed an experiment on the B. C. & N. R. R. with an eight-wheeled engine up a heavy grade. It went over the grade with 18 cars with the traction device applied. Then it went over just as easily with the 18 cars without the traction increaser.

Mr. Briggs could not see how an engine could do as good work with 3,000 to 10,000 pounds less upon the drivers. We should inquire into the advantages of traction devices, so as to utilize engines now too light for the traffic.

Mr. Setchel could not see why the additional weight is not an advantage. Locomotive builders put on various things to increase weight, to help traction. Some have put on cast iron cabs.

Mr. Sinclair said this Association ought to favor a better method of getting traction than by putting extraneous weight upon the drivers. It should favor improved designs rather than makeshifts to overcome the troubles of bad designs.

Mr. Johann substantially agreed with Mr. Sinclair. He favored equalizing the weight upon drivers by better methods than by special traction increasers.

Mr. Briggs said there are many engines in use that were not built theoretically correct. The traction increaser applies to them. He questioned whether it would not be well to have it so the weight can be applied when needed, and build engines a little lighter, so as to save both engine and rail.

Mr. Setchel contended that every pound of dead weight not needed is a loss. We should utilize the weight we are obliged to carry about. Weight is as necessary in tender or tank as it is in the engine. We should utilize this if we have power enough to utilize it.

Mr. Hatswell (F. & P. R. R.) had used the Locomotive Improvement Company's device; also had used cast iron cabs to get enough weight on drivers. He got so much weight that he broke the springs.

Mr. McCrum had found that a 17″x24″ five-foot wheel engine, weighing 48,000 pounds, was two cars better with the traction increaser than without it. He will put traction increasers on six or eight more of their locomotives. He would like to know why weight is not as efficient when transferred from tank to drivers, as when put upon drivers direct.

Mr. Hatswell said he did not seem to get results same as others. It looked as though 5,000 pounds added would help traction, but it did not help him to draw one more car. Perhaps he did not apply it right, but he would like to know why.

Two papers were presented by men who are not members of the Association. Mr. Lawson, by invitation, read a paper defining his views upon the cause of boiler explosions. By a vote of 31 to 22 the Association decided to lay it upon the table. Otto Gruninger presented a paper on the development of different valve gears.

Providence Screw-Cutting Lathe.

This lathe is a strong, well built tool, possessing several important features of construction, some of which are represented by detail views. It is designed for use on electrical work, sewing machines, or other light work, and is a very convenient tool for amateurs. It will turn 18″ long, 4½″ diameter, and swing 8″ over the bed. The gearing furnished enables screws to be cut from five to the inch up to very fine pitches.

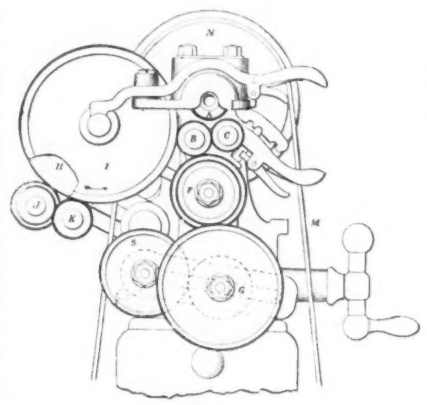


FIG. 1.

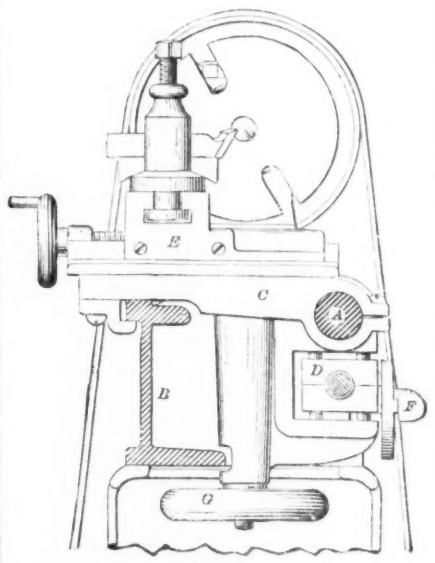


FIG. 2.

It has a hollow steel spindle to take rods up to $\frac{5}{16}$″ diameter. The spindle bearings are straight, with adjustment for wear. The centers are fitted to Morse taper.

The tailstock has set-over for turning tapers, and the slide rest swivels on the carriage.

Fig. 1 represents some of the features of this lathe. The gear teeth are represented by heavy black lines. *A* is the spindle gear, shown disconnected from the right and left gears, *B* and *C*. It will be observed that if the back gear is disconnected there will be no gears running in connection with the spindle, so it can be run at high speed without noise. The lever, *E*, connects either the right gear, *B*, or the left gear, *C*, with the spindle gear, thus driving the screw, *S*, right or left, as desired; *F* is the fixed stud, and *G* is the intermediate stud. On coarser threads the gears on the stud, *G*, may act as intermediate; on fine threads it may be compounded, as shown; this gives a very wide range of threads. An index plate accompanying each lathe gives 29 threads, but many others may be obtained, or gears may be made for special threads.

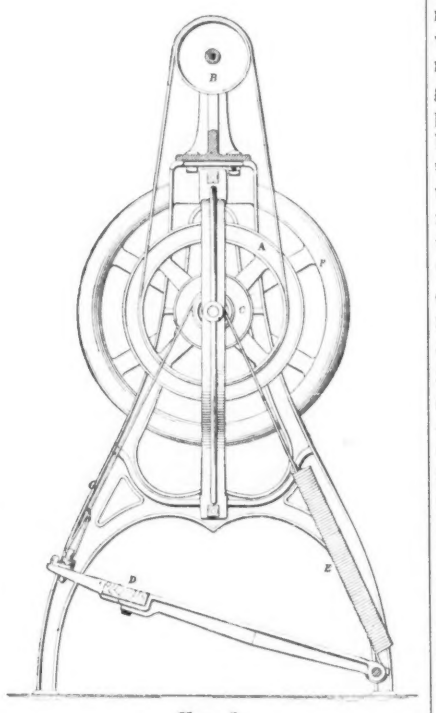
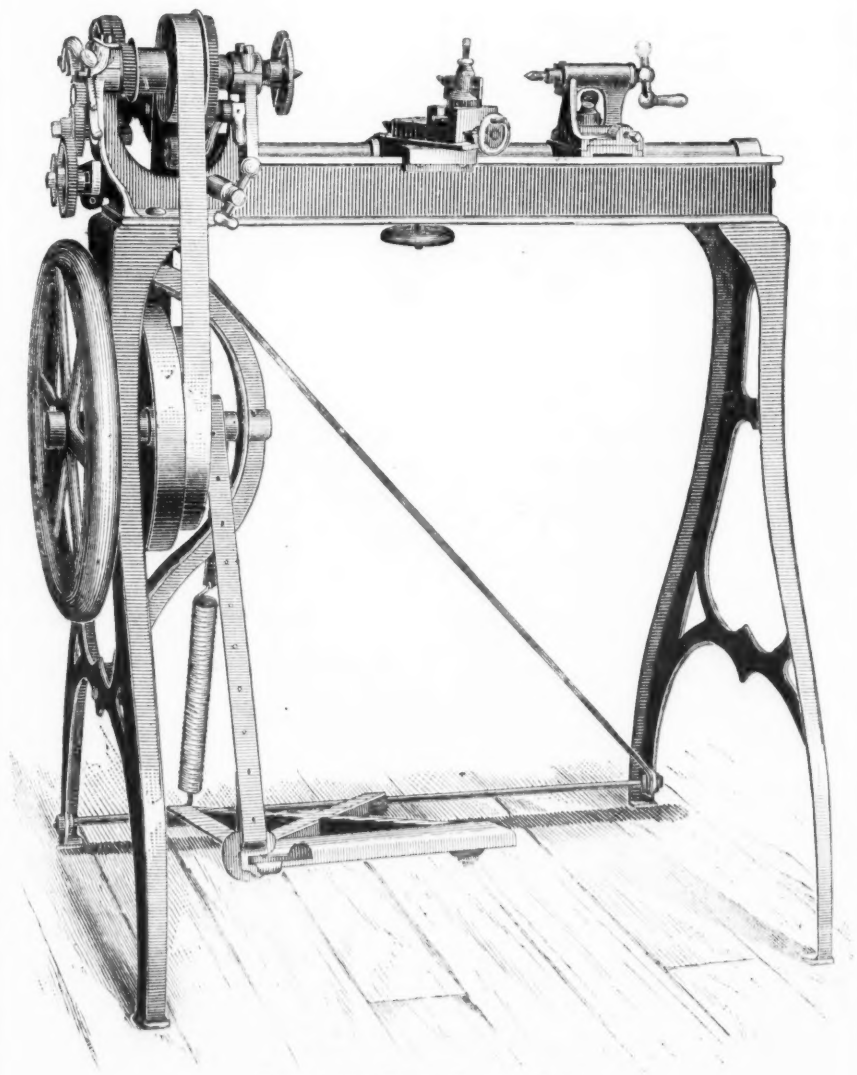


FIG. 3.



PROVIDENCE SCREW-CUTTING LATHE.

This system of gearing is very direct and simple. The screw-cutting train of gears are all 20 diametral pitch, and the back gears 16 pitch.

By means of a novel motion the spindle may be instantly reversed at any point and run backwards without stopping the lathe. This is entirely separate from the ordinary right and left motion, and completely reverses the spindle and screw-cutting gearing, running the carriage back while the lathe is going at full speed forward. This is accomplished by means of an addition to the usual back gearing. On the same shaft with the usual large back gear, *H*, is the gear, *I*, of the same diameter; these gears are connected by means of the gears, *J* and *K*, thus the motion of the gear, *I*, is exactly the reverse of the gear, *H*. Now, as these gears (*H* and *I*) are on the back gear shaft, and revolving loosely in opposite directions, and as the spindles are driven through these gears, it only remains to connect the back gear shaft with either the regular back gear, *H*, or the oppositely running gear, *I*, to produce a forward or backward motion of the spindle. This is done by means of a clutch operated by the lever, *L*. Then, if, while the belt, *M*, and pulley, *N*, are running forward, the lever, *L*, is pressed towards the pulley, *N*, the gear, *I*, will be connected with the shaft, and the spindle will run backward, carrying with it the screw-cutting gearing, and running back the carriage to start another cut. It will be noticed that the train of gearing from the spindle to the screw remains unbroken, hence the operation of the reverse gearing is precisely the same as that of a countershaft with straight and cross belt.

Fig. 2 is a view of the carriage and section of one of these foot lathes, showing the bed in section. The front side of the bed consists of a single casting 3⅜″ deep, as shown at *B*. In place of planed **V**'s to guide the carriage, *C*, a compressed steel bar, *A*, is used at the back, as shown; the front being gibbed to the bed, *B*. The bed is deep, and being directly under the tool-post, receives all the pressure from the same, the bar acting only as a guide. The bar and bed being placed well apart, form a broad and firm support for the carriage.

The screw, *D*, is placed close to the guide bar, *A*, thus avoiding any cramping of the carriage. By means of the cam, *F*, the half nut may be separated and the carriage detached from the screw, and moved by hand to any part of the bed. The slide rest, *E*, is secured to the carriage by a bolt, which is tightened by the wheel, *G*. It may be set at any angle for turning or boring tapers, or instantly removed and a **T**-rest holder, or other devices, substituted. The slide rest and carriage are milled true on their edges, so that the slide rest may be easily set square with the guide bar. The top part of the slide rest extends back so as to cover the wearing parts and protect them from chips and dirt; it also acts as a support for the tool. The point of the tool may be raised or lowered by means of the convex washer and concave shoe. The slide is gibbed, to provide for any adjustment it may need.

The foot power is shown in Fig. 3. On the lever pulley shaft is a clutch, *C*, which, when the treadle, *D*, is pressed, engages with and gives motion to the pulley. On the stopping or returning of the treadle, the pulley continues its rotation, so the strokes may be long or short, quick or slow, at the will of the operator. The spring, *E*, raises and balances the treadle.

The cone, *B*, has two steps, 2½″ and 5″ diameter. The lower cone pulley has steps, 12″ and 9¾″ diameter. An additional balance wheel, *F*, is provided.

This foot power is all ready to start from any position, and no power is wasted on it. With back gears a speed of 25 revolutions may be kept up; without back gears the speed may be varied from 120 to 3,000 revolutions. It always starts in the right direction. The foot can remain at rest on the treadle while the machine continues to run, thus avoiding the motion necessary to crank motions, even when power is not needed. This last feature is one that will be appreciated in delicate operations.

This lathe is made by the Narragansett Machine Company, Providence, R. I.

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NEW YORK, JULY 4, 1885.

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Credit for Making Industrial Progress.

Credit for making advances and improvements in every-day industrial processes belongs to those who let the public know what they have done, and how they have done it. The individual who makes a valuable discovery in the useful arts, and keeps the knowledge to himself alone, may be able to turn it to profitable account and benefit others to some extent, but he cannot claim much public gratitude. Perhaps acknowledged credit and kindly appreciation by the great mass of people are not considered worth making an effort to secure by some who toil to unravel the mysteries of Nature's laws. To others they bring gratification as recognition of efficient services rendered to mankind. Sometimes a strong desire for public recognition for some unquestionably successful work comes after another person who has accomplished the same results at a later date proclaims his process, and is accorded public praise as the originator of the same. An example is before us in a letter received from a foundryman, who writes: "I have no improvements to offer at present, only to say that I melted steel in the same manner as Mr. Masters as early as the spring of '77; and, furthermore, I continue to do it up to the present time. My object in writing you this letter is to inform the readers of the AMERICAN MACHINIST that Mr. Masters is not the first one who has melted steel in the form he speaks of, and I don't think it's right he should receive all the credit."

If the writer of the above letter would supplement the process already described by Mr. Masters with additional information developed in his own experience, and lay the same before the mechanical public, he might claim credit, and there would be no doubt about his receiving it. As he has kept the knowledge of steel melting closely confined for eight years, and mentions it only after Mr. Masters has freely given it to the mechanical public through the columns of the AMERICAN MACHINIST, he will not take away any of the credit accorded to Mr. Masters. Since the process was first described in our columns we learn that foundries in different parts of the country are applying it with undoubted benefit. Others have added valuable notes from their own experience in making castings from iron and steel scrap, which we have also published, and which have not lacked appreciation. Credit is due not so much for what one knows as for what he communicates. That philanthropist and eminent orator, the late Wendell Phillips, used to hold large audiences spellbound by the power of his eloquence while he depicted "the lost arts" that perished with the lives of those who zealously guarded them from revelation. The last sentence of that lecture was a moral never to be forgotten. It was: "No man has a *right* to know that which he will not use to help his fellow man."

The Much-Tried Dolphin.

It seems that at length the Dolphin is to have a rest. The Board appointed to examine her has, according to the *Sun*, reported the vessel unseaworthy, that she cannot make the contract speed, and, in fact, makes out a strong case of her general uselessness. She has neither speed to run away nor ability to defend herself. It has been evident from the beginning that the Dolphin was not to be a valuable addition to the navy, and more recently it has been evident that bad mistakes, either in design or construction, had been made. Just where the responsibility for the failure lies is not so clear. If constructed entirely from the plans of the Advisory Board, and in strict accordance with these plans, it would appear plain that the Government was responsible; and dodging this responsibility, as we understand the Examining Board advises, on the ground that the Government is not bound by illegal acts of subordinates, is a cowardly way out of the difficulty. The Dolphin appears to be so weak that a slight change in her load throws her machinery out of line, so as to cause heating of journals. The builder may or may not be responsible for this; there appears to be evidence of a general looseness in the whole matter of the contract that leaves this point in considerable doubt. There has been a good deal of senseless talk in the daily papers about this boat, some of which has been echoed by journals that ought, from the position they aim to occupy, to discuss the matter fairly or not at all. Nothing but a little cheap notoriety has so far been gained by abusing John Roach on general principles, as it has been impossible to determine where the blame lies. It having been conclusively demonstrated that the boat is practically worthless for the purpose for which she was built, it ought to be easy to fix the responsibility. Until this is done, indiscriminate condemnation of the builder is not in good taste.

In the statements and opinions from workmen to the Bureau of Statistics of New Jersey, complaint is made by a Jersey City engineer that no license or inspection laws are in force, and that as a result boys and incompetent persons are employed, to the danger of life and property. This is true, as has been proved by some bad accidents from boilers in Jersey City, but it is questionable if engineers will get much benefit from complaints to the bureau. We believe that such laws should be in force, but have no idea they ever will be until the engineers themselves act in the matter. Let them circulate a petition to the Legislature demanding such laws, and get, which we think they can, about nine-tenths of the voters to sign, and some attention will be paid to it. It is a matter of public welfare, and not something especially to favor engineers; the owners of steam boilers and engines would be quite as much benefited by such laws as the men who take charge of them.

Once in a while we have a practical example of an effort to reduce friction in machinery, and when we do are generally impressed with the idea that it is a greater percentage of the total power than it is usually represented to be. As an instance, we recently heard of a mill owner who set himself vigorously at work to reduce the friction in an engine and roll train, the result being that whereas nothing less than 80 lbs. boiler pressure would do the work before his efforts, afterwards 60 lbs. would do it equally as well. He used one less boiler to supply steam after his fight against friction.

Iron Ores in the United States.

"A Bird's Eye View of the Production and Characteristics of Iron Ores in the United States, with Statistics of Imports of Foreign Iron Ores in Recent Years," is the somewhat lengthy title of a pamphlet just published by James M. Swank, Philadelphia, vice-president of the American Iron and Steel Association. From it we learn that the United States imported, during the year 1884, 487,820 tons of iron ore, being about one-half the quantity imported by Germany, one-third that imported by either France or Belgium, and a little over one-sixth that imported by Great Britain. In August, 1884, an American company began importing iron ore into the United States from the Juragua mines of Cuba, the shipments in 1885 being expected to reach about 100,000 tons.

The pamphlet estimates the aggregate consumption of domestic iron ore in the United States for the year 1884 as 7,718,129 tons. It estimates that in this country an average of 2.03 tons of iron ore is required to produce a ton of pig iron, while the average is 2.4 in Great Britain, 2.6 in Germany and France, and 2.7 in Belgium.

The pamphlet contains a mass of statistics in detail relating to the manufacture of iron, concluding with the statement that pig iron suitable for the manufacture of Bessemer steel by the process now in use in this country, has never been made in any part of the country south of the Potomac, or south of Wheeling, southern ores being too high in phosphorus for the purpose mentioned. It also suggests that if the South should engage in the manufacture of Bessemer steel, it would probably employ either the Thomas-Gilchrist process, which requires that pig iron should be high in phosphorus, that the work of elimination in the converter may be completely successful; or the Clapp-Griffiths process, which is said to permit the presence in the steel itself of a large percentage of phosphorus without detriment to its quality, a result only rendered possible by the rigorous exclusion of silicon.

Technical Education.

Dr. Percy, of London, in an address before the British Iron and Steel Institute, expressed the opinion that the attempt to convey to artisans the impression that all would be alike benefited by technical education was wrong. He thought they would interpret the word benefit as meaning increase in wages, and that in this way they were likely to be disappointed. He instanced file-cutting as an example, and thought that any amount of knowledge of iron and steel would not increase the skill of the file cutter.

This may be very true, but we think Dr. Percy does not do justice to the intelligence of artisans, or comprehend the true scope of technical education. Because a man is engaged in cutting files to-day, it does not follow that he will be thus engaged a year from to-day, not if in the intervening time he has learned to do something that pays or suits him better, and the knowledge of the properties of steel and iron may be just what he lacked. The greatest value of technical education to artisans is that the knowledge gained beyond what they would acquire "in the ordinary practice of their respective arts" makes it possible for them to fill positions higher than those they are already filling. To assume that they do not understand this is a mistake.

Mr. J. H. Setchel, late general master mechanic of the Ohio & Mississippi Railway, and for many years secretary of the Master Mechanics' Association, has been appointed superintendent of the Brooks Locomotive Works. Mr. Setchel's previous experience in railway management will be of special service to him in directing the mechanical operations involved in locomotive construction.

There is nothing in which a community, large or small, can better show that its combined head is level than by showing that it appreciates its manufacturers. Jersey City, N. J., has recently done itself proud by making John A. Walker, of the Joseph Dixon Crucible Company, president of the Board of Education. Under the guidance of Mr. Walker there can be no doubt in which direction the young idea will hereafter learn to shoot in the chief city of Jersey.

Fink Again on His Travels.

We learn that "Henry Fink & Son," as represented by the persuasive John Fink, have found at least one more victim at Paterson, N. J., within a few days, in the way of a purchaser of the shop right to use their famous lubricating humbug, which, our readers remember, was ventilated in our issues of March 22, April 12, May 10, and July 12, 1884. Fink came, as usual, armed with the historic bound volumes of "testimonials," bagged another customer, and went away with another testimonial, of course being in a hurry to "catch a train." The trade would not have been consummated but for the fact that the mechanical partner (who regularly reads the AMERICAN MACHINIST), was absent that day; hence these tears on the part of this latest victim to Fink's persuasive wiles. Look out for Fink and his lubricating humbug.

The Convention of Railway Master Mechanics at Washington, last week, continuing three days, was a very successful one. With a membership in the association much less than half that of the Society of Mechanical Engineers, more members were in attendance, and the number of visitors was many times larger. The discussions, all of which

referred to matters of practical importance, elicited much valuable information. Twenty new members were added, making 256 in all. It was a disappointment to many that the committee on shop tools and appliances did not have a report ready to present. The report on steel castings, which we publish on another page, is a specially interesting one. We shall give attention to other reports in future issues.

Literary Notes.

HEALTHY FOUNDATIONS FOR HOUSES. With 51 Illustrations. By Glen Brown. Reprinted from the *Sanitary Engineer*. New York: D. Van Nostrand, publisher, 23 Murray and 27 Warren Streets.

This little book is written in plain terms, so as to be understandingly read by any one. It sells for 50 cents, and every householder, or any one about to build or buy a house, will find information in it worth to him several times the price.

POCKET-BOOK OF MECHANICS AND ENGINEERING. Containing a Memorandum of Facts, and Connection of Practice and Theory. By John W. Nystrom, C. E. Eighteenth edition. Revised and greatly enlarged with original matter. Philadelphia: J. B. Lippincott Company.

This book long since made a place for itself in mechanical and engineering circles, and those who have heretofore used it will appreciate the enlargement to the extent of about 200 pages, including a large number of tables and illustrations. It is now a book of 671 well-printed pages, bound with serviceable Morocco flap. The price is $3 50.

The Accident News is the name of a new monthly publication issued by James R. Pitcher, secretary of the United States Mutual Accident Association, 320 Broadway, New York. It is filled with matter pertaining to the subject of accident insurance on the mutual plan, a subject, doubtless, of interest to many persons employed about machinery.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(200) **W. G., Leadville, Col., asks:** Does a narrow-gauge locomotive curve easier than a wide-gauge, everything else being equal? *A.*—We believe the narrow-gauge will curve slightly the easier.

(201) **A. F. U., Minerva, Ohio, asks:** Will a piece of steel hardened and drawn to a certain color (say a bright straw color), and then ground or rubbed off and drawn again, be any softer than after the first drawing? *A.*—According to the theory of color and temper, if drawn the second time to exactly the same color the temper should not be started. We believe, however, that it will be a trifle softer after the second attempt.

(202) **R. H., Georgetown, Ont., writes:** We want to take steam from a factory boiler to house, about 300 feet distant, through a 1½″ pipe, pipe to be laid in a plank box, with air space. What will be the loss, and how much will it improve it to cover it with felt, or what is the best way to lay it, at not too great expense? *A.*—Cover the pipe with some one of the prepared pipe coverings, then box it around (we suppose it to be underground). The expense will be small, and the loss of heat trifling.

(203) **Cartridge, Catasauqua, Pa., asks:** Can you tell what pressure per square inch will be required on the head of a plunger working in a cylinder 6″ diameter to compress material of the consistency of core sand into a core or cartridge 6″ diameter and 10″ long, the core to be similar to a foundry core when completed, and to be done with one stroke of the plunger; also what pressure per square inch will be required on same plunger to compress at one stroke material of the same consistency into one-half its bulk, the material being loosely shoveled into the cylinder? *A.*—We do not think you will be able to make a core of the length named anything like uniform in solidity by one stroke of the plunger. It is not possible to tell what pressure would be required. You must determine experimentally. Why not try the experiment by the aid of a hydraulic wheel press in a railroad shop?

(204) **J. H. H., Brantford, Ont., asks:** 1. Does not a tap or reamer cut larger if made with five flutes than if made with three? *A.*—We have never noticed, or believe that they will cut larger; they will generally tap or ream a hole more nearly round. 2. What is the definition of epicycloidal? *A.*—The epicycloidal curve is a curve used sometimes for the teeth of gear wheels, and for other purposes. You will find the word defined in any English dictionary, and the curve more fully described in any treatise on the teeth of gear wheels. 3. What means are used to back off the teeth of epicycloidal cutters for the teeth of wheels? *A.*—A lathe is arranged specially to turn the clearance. The arrangement cannot be described without drawings.

(205) **L. M. A., ——, writes:** I would like to have you answer three questions on screw cutting. 1. How far should one thread measure from the next one when it is ⅞″ pitch? 2. What would be the pitch when there was one thread in ⅞″? 3. Can you give me a rule for finding the pitch when the distance from one thread to the next is known? *A.*—You seem to be confused by the "pitch" of a screw and the "number of threads to the inch." These terms are frequently used synonymously, but they should not, for the sake of clearness, be so used. The pitch of a screw (single threaded) is the distance from one thread to the next one, hence the answer to your two first questions is ⅞″. Knowing this distance, you can find the number of threads to the inch by dividing the denominator of the fraction expressing the distance by the numerator. Thus, in your example, the pitch is ⅞″, and the number of threads to the inch is 8÷7=1 1-7. Conversely, if you know the number of threads to the inch you can find the pitch by dividing one inch by the number of threads to the inch, thus 1 1-7 threads to the inch is 1÷1 1-7=⅞.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Katzenstein metallic packing, 169 Christopher st, N.Y.

Edw. Sears, wood engraver, 48 Beekman, St., N.Y

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Tools for amateur and foot-power lathes. Send for illustrations. Hartford Tool Co., Hartford, Ct.

Light fine interchangeable mach'y to order. Foot lathe catalogue for stamp. E. O. Chase, Newark, N.J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

We will close at forced sale twist drills, taps, etc.; order early. York & Burton, Cleveland, O.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

Improved Labor-Saving Upright Drills, B. G. & S. F.; prices reasonable. Currier & Snyder, Worcester, Mass.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught," $4. Books for workmen Joshua Rose, Box 3306, New York City.

Morrison's Practical Engineer, a complete treatise on steam and general machinery. Price, $1; mailed free. Indicators, Engineers' Instruments and outfits. W. A. Morrison, Box 373, Lowell, Mass

Locomotive Engine Running and Management. By Angus Sinclair. Price $2, An excellent book for men interested in steam engineering, valve setting, designing valve motion, the care of the Westinghouse brake, etc. Published by John Wiley & Sons, 15 Astor Place, N. Y.

Useful Information for Steam Users—A 100-page pamphlet, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Every engineer should have this book. Send 25c. in P. O. stamps to the J. N. Mills Publishing Company, 165 Broadway, N. Y.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

An article in *The Sanitary Engineer* of June 4 gives some valuable data for engineers and boiler makers, in the shape of illustrations of twenty-five boiler heads, and a table showing the number and size of boiler tubes that can be put in a given size boiler head, with the square feet of heating surface to each boiler. Single copies of newsdealers, 10 cents. Subscription, $4 per year. Published weekly at 140 William Street, New York.

Manufactures.

Blount & Hill, East Point, Ga., will erect a plow and wagon shop.

The Albany (N. Y.) Brewing Co. will extensively enlarge their brewery.

D. B. Flint will erect a $26,000 factory at 9 to 13 Water Street, Boston.

H. H. Hunnewell will erect a $95,000 factory at 91 to 99 Causeway Street, Boston.

The Shawnee Coal and Iron Co., at Newark, O., will erect a new machine shop.

E. & A. Mudge's boot and shoe factory, Danvers, Mass., recently burned, will be rebuilt at once.

The citizens of Midlothian, Texas, are making an effort to establish a woolen and cotton factory.

T. H. Doan will erect a six-story brick factory on Second Street, between Arch and Cherry Streets, Philadelphia.

The people of Coeyman's, N. Y., have donated land to the West Shore Railroad in that village upon which to erect shops.

A Brooklyn inventor advertises for a "capitalist to push an engine through." He wants a locomotive financier, so to speak.

The Western Nail Co., Bellville, Ill., will build a large plant for making steel nails. The cost is mentioned as from $100,000 to $500,000.

Thomas Elchor & Co., Uniontown, Pa., will erect buildings this summer at the above place, to be used by them as a foundry and machine shop.

E P. Bullard, 14 Dey Street, New York, has been appointed Eastern agent for Geo. D. Walcott & Son, Jackson, Mich., who build lathes and shapers.

The Marvin Safe Company, New York, will erect a seven-story factory, to cost $75,000, exclusive of equipment. A lot of new machinery will be put in.

R. A. Belden & Co., of Danbury, Conn., have organized a stock company to build planers and chucks. The capital of the R. A. Belden Co. is $24,000.

The Good Cheer Type Writing Manufacturing Co., of Greenfield, Mass, are to make an invention of C. E. Tilton, brother of F. G. Tilton, which is to be sold for $20.

The Burleigh Rock Drill Co., Fitchburg, Mass., are bringing out a new refrigerating and ice-making machine. They have sent several sets to the Southern States.

Ground has been broken at Chicopee, Mass, for a brass foundry which C. C. Abbey is to build. It will be about 30x40 feet, and of brick, and will be finished by July.

The *Grand Rapids Morning Telegram* says The Newth Locomotive Ash Pan Co., lately incorporated with $50,000 capital, will establish a factory at Detroit, Mich.

Geo. C. Howard (elevators), 19 South 18th Street, Philadelphia, writes us: We have been busier for the past three months than for three years previously, on work secured at lowest current prices.

The Willow Dale Company, of Meriden, Conn., occupy a number of buildings in addition to their main woolen mill, which is a 4-story structure, 310 feet long by 60 feet wide, and built entirely of brick.

The New York Elevated Railroad Shops will not be built until next year, although reports have been published that they will be erected this season. They have erected new car sheds to accommodate 150 cars.

The English stockholders of the Sanderson Steel Works, of Syracuse, N. Y., are buying out the American stockholders at about 50 cents on the dollar, and will probably settle the claims against the company.

The erection of a new woolen mill at Madison, Maine, was begun by the Madison Woolen Company on June 1st. It is to contain 8 sets, and the purpose is to have it completed and in operation by next winter.

The Wagner Car Co., of Buffalo, N. Y., contemplate the removal of their works to Amsterdam, where they will erect a large shop. The city of Amsterdam has offered free all the ground which the company may want.

The Sheldon Axle Works, heretofore located in the Auburn, N. Y., State prison, will be established in Scranton, Pa. About $150,000 of stock has been subscribed in that city. They will erect rolling mill, forge shop, finishing room and foundry.

A bonus of $12,000, together with ground, buildings, etc., has been secured in Fort Worth, Texas, to induce the establishment of a cotton mill in that city, about which negotiations have been pending for some time.—*Baltimore Manufacturers' Record.*

Machine shops and a large blacksmith shop will soon be added to the State Prison at Thomastown, Me. The State very generously builds and fits up shops for prison contractors, who use the shops rent free. Other manufacturers can pay for their own shops, and pay taxes to the State upon the value of them.

P. L. Kimberly, of the Etna Iron Works, of this city, in connection with a partner, is about to erect in the near future, at Sharon, an extensive steel works. It is said that the works, when completed, will cost the company $1,200,000.—*New Castle (Pa.) Guardian.*

The Lyons Manufacturing Company, of Syracuse, N. Y., were burned out some time ago. A new company—capital $15,000—has been formed by Thomas H. and Amy B. Lyons and H. D. Scudder. A new building will be erected, and the manufacture of carriages and sleighs continued.

P. Blaisdell & Co., Worcester, Mass., have been engaged in building machine tools about fifteen years, during which time they have sold their upright drills and lathes to all parts of the country, especially in the North and West. They are now getting a good trade from the South. Recently they have altered and improved their patterns.

The Manhattan Hardware Company have finally concluded to remain in Reading, Pa., and have purchased ten acres of ground in the northeastern section of the city, extending from Rose to Richmond Streets. Building will be commenced as soon as possible. The new place will be started about next fall, and will employ from 500 to 1,000 hands.

Hobson, Benson & Co., of Raritan, N. J., announce by circular that they have purchased the agricultural works at that place, and will continue the manufacture of Raritan mowing machines, steam, horse and hand-power corn shellers, threshing machinery, grain drills, the Raritan horse hay rake, land rollers, cultivators, feed cutters, horse-powers and agricultural implements generally; also gray iron castings of every description.

A new engine lathe for turning shafting is being built at the Columbian Iron Foundry and Machine Tool Works of Chicago. It is the invention of Nicholas Thomas, the Superintendent of the works, and as an especial feature has the bottom formed into a trough to be filled with water, in which the shafting to be turned is submerged. The cutting tools, three or four in number, are set in a circle and made double. They are set starting at opposite ends of the shaft and work towards the center; or, if preferred, they may be set in the center and worked outward to the ends of the shaft.

The Manhattan Brass Co., 475 First Avenue, New York, began operations June 1st for the erection of an additional brass works at 28th Street, near First Avenue. It will consist of a 75x90 feet 5-story brick building, and is expected to be ready for occupancy January 1, 1886. They will put in plant for the employment of about 200 men, additional to the 600 men already in their present works. The company, however, do not propose to occupy the whole of the new building unless trade shows a considerable improvement during the present year. They may rent a portion of the new building.

The Delamater Iron Works, 16 Cortlandt Street, New York, say their business in steam pumps and pumping machinery generally has been for the past three months decidedly on the mend, inquiries being more frequent and orders more free. Prospects good. Since the Ericsson hot air pumping engine was presented to the mechanical public in the AMERICAN MACHINIST of June 19, 1880, more than 5,000 have gone into use. The Rider hot air engine, also made by the same concern, and intended for heavier work than the Ericsson, has recently been adapted to a number of new uses, one being for pumping water for irrigating purposes.

The *American Journal of Fabrics* says: But few knitting mills are running on full time. The majority of them seem to be running on three-fourths time. Even the latter, in many instances, use only one half to two-thirds of their machinery. A big curtailment in production has been going on for a long time past, which, if not so fully felt in the meantime, will be very sensibly felt in September and October. Another feature which tends to strengthen the market is the 12½ per cent. advance demanded in wages, which has been further supplemented by an additional increase of 10 per cent. to the spinners in some of the manufacturing centers.

The Jones Car Works in Schenectady, N.Y., have been leased to the New York Central Sleeping Car Co. for one year, with the privilege of purchase at the end of lease. The Sleeping Car Co., intends to use these works for all the repairs required to its cars, and also for the construction of new cars, and the work now done in the Buffalo repair shops will be transferred to Schenectady at once. The New York Central Sleeping Car Co. has also leased the buildings erected some two years ago for the McQueen Locomotive Works, which have never been stocked with machinery. These buildings, which adjoin the car works, are extensive, and can easily be arranged for the company's purposes.—*Railroad Gazette.*

The Eclipse Wind Engine Company, Beloit, Wis., report a good business. They have lately shipped one carload of their windmills to Boston, Mass., one carload to Cleveland, Ohio; one carload of mills and pumps to St. Louis, Mo; one carload to Lincoln, Neb.; one carload to Lyons, Kansas; one carload to Mulvane, Kansas. They have a contract to furnish the Minnesota & Northern Railroad with tanks, pumps and complete water supplies for 11 water stations. They manufacture solid-wheel windmills, and iron and brass pumps in 19 sizes, and have agencies and warehouses in 16 of the largest cities of the United States and Europe. The Eclipse Windmills withstand storms that tear some mills to pieces.

J. & J. Dobson, Philadelphia, will build a two-story addition to their worsted yarn mill at Manayunk.

A. Beck, Philadelphia, will build a new carpet mill 180'×5', with engine and boiler house at the side of the mill.

The Bardstown Axe Handle Company are to build a factory at Bardstown, Ky., and equip it with the necessary machinery, including engine and boilers.

The Paducah Furniture Company, of Paducah, is replacing its former building, burned a short time since, with a new structure, to cost about $12,000. Elevator will be put in, and machinery fitted out new—*The Tradesman.*

Machinists' Supplies and Iron.

NEW YORK, June 18, 1885.

The supply business remains in the same condition as during the last six months, with no indication of change. Dealers are in position to fill orders immediately, and buyers avail themselves of this to order no faster than required for immediate necessities.

Manufacture is moving quietly, selling at remarkably small profits.

Iron—In American Pig stock offered exceeds the demand, and buyers are generally able to obtain concessions from asking prices. We quote No. 1 Foundry, $18; No. 2 Foundry, $17; Grey Forge, $14 to $15.

Scotch Pig—Business in these brands is remarkably quiet, with prices in favor of buyers. We quote Shotts $20 to $20.50; Coltness, $20 to $20.50; Gartsherrie, $20; Summerlee, $20; Cambroe, $18.50 to $19; Eglinton, $17.50 to $18; Langloan, $20 to $20.50; Dalmellington, $18.50 to $19.

Copper—The market is quiet and hardly steady, sales being in some instances made at slight concessions from asking prices. Lake is held at 11⅜c. to 11½c.; other brands 10½c. to 11c.

Lead—There has been speculative movement in lead, about all the supply having been taken at 3.65c. to 3.80c. The intention is evidently to advance prices, but consumers are slow to respond.

Spelter—Refined, 8c. to 8⅜c.

Tin—London market is in an uncertain and fluctuating condition, which has had the effect to advance prices here to 21½c. to 21¾c.

Antimony—Hallett's, 9¼c.; Cookson's, 9½c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Situation as foreman or superintendent of machine shop. Lock Box 568, Philadelphia, Pa.

Position as foundry foreman by man of 35 years' experience, 20 as foreman; best references. S. W., AM. MACHINIST.

Situation by toolmaker capable of designing and building light special machinery, gigs, etc.; is good draftsman; ref. given. Address Indicating, 88 John Street, Bridgeport, Conn.

Wanted—Immediately, a first-class man in every respect, fully competent to act as foreman in charge of shop for building tools and machinery. Address B., Box 4, AM. MACHINIST.

Wanted—By an experienced German wire nail maker, to join some party to start the manufacture of all kinds of wire nails and wire tacks. Address "Wire Nail," AM. MACHINIST.

Wanted—Situation by first-class pattern-maker, experienced in gearing, machinery, engine and mill work; is good draftsman and capable foreman; highest references. Address Box 3, AM. MACHINIST.

Wanted—Situation as foreman moulder, by a practical man; 19 years' experience; accustomed to all classes of work—core making, mixing and melting of metals; reliable, temperate and progressive; references. Address J. M., AM. MACHINIST.

A mechanic and educated engineer of 18 years' active experience, is open to an engagement in any capacity as superintendent or assistant to president or manager, in any description of mechanical work. Please address Mr. X., Box 5, AM. MACHINIST.

A competent boilermaker is open for an engagement as foreman, or would take a job at piece work; can make drawings and estimates; knows how to work men and tools up to their full capacity; can give first-class references. Address Boiler Shop foreman, AM. MACHINIST.

✻ MISCELLANEOUS WANTS ✻

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Wanted—Address of cheap automatic engine builders. B., 51 Plane, Newark, N. J.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

For Sale—A Crosby Improved Nickel-Plated Indicator, with 40 and 50 Springs and scales; been used but a short time, and in first-class condition. Price, $65, cash. Address Box 2, AM. MACHINIST.

CHANDLER & FARQUHAR,

GEARS

177 & 179 Washington Street, BOSTON, MASS.

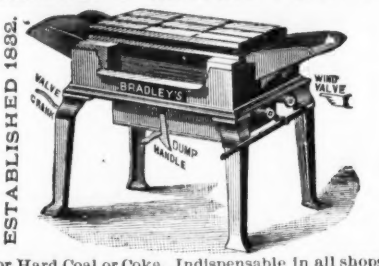
Of all kinds in Stock and Made to Order.

Estimates Furnished for Models or Light Machine Work.

Tools and Supplies for Machinists and Manufacturers.

Send for Catalogue B.

BRADLEY'S HEATING FORGES.



ESTABLISHED 1832.

For Hard Coal or Coke. Indispensable in all shops to keep **Bradley's Cushioned Hammers** and men fully employed and reduces cost of production.

BRADLEY & CO. Syracuse, N.Y.

SPECIAL NOTICE.

All parties making, selling or using an Upright or Heive Power Hammer having a Cushioned Vibrating Saddle, infringe our patents, and we shall hold them legally liable for the same.

BRADLEY & COMPANY, Syracuse, N. Y.

Massey's "E AND K" PATENT VISES

T. C. MASSEY, SOLE MANUFACTURER

EASTERN DEPOT LINK-BELT CO. No. 61 TOWN ST. N.Y.

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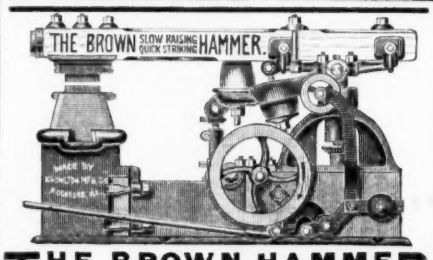
SIMPLY CONSTRUCTED AND DURABLE CONVENIENT



THE BROWN HAMMER

STRIKES A BLOW WITH

DOUBLE THE VELOCITY That it Raises the Hammer

A NEW MOVEMENT! SEND FOR DESCRIPTION

KNOWLTON MFG. CO., King St., Rockford, Ill

The Fireman's Guide.

A Handbook on the

CARE OF BOILERS

By KARL P. DAHLSTROM, M. E.

Crown 8vo, Cloth, 50 Cents.

E. & F. N. SPON, 35 Murray St., New York.

STEPHENS PATENT PLANER CHUCKS

Combine valuable features offered by no other tool. In range of opening; advantage of self-adjusting jaw worked by a single screw; graduated bar, etc. Parts interchangeable. Chucks guaranteed. Sold by the trade. Send for Catalogue.

Self-Adjusting.

MELVIN STEPHENS, Prop'r, Office, 41 Dey Street, New York.

FOR SALE AT A BARGAIN.

A well established and good paying machine shop and foundry, including buildings, lots, machinery and stock, situated in Leadville, Col. The business will be carried on until sold, thus at once giving a profitable trade to the purchaser. Address,

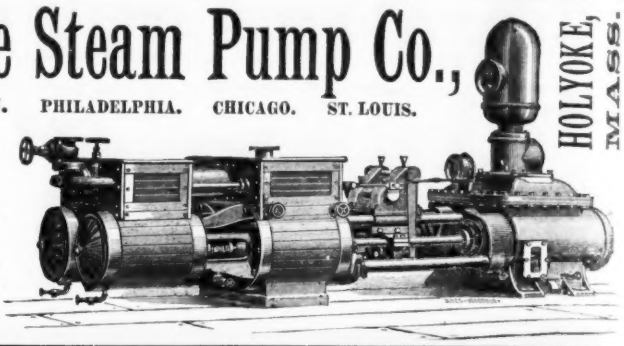
A. FALKENAU,
Care of Dickson Mfg. Co.,
Scranton, Pa.

Only reason for selling, ill health.

The Deane Steam Pump Co., HOLYOKE, MASS.

NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.

MANUFACTURE PUMPING MACHINERY FOR ALL DUTIES.

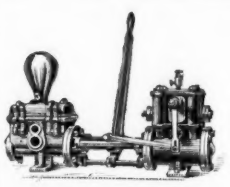


Send for New Illustrated Catalogue.

Established in 1874.

CLEVELAND TWIST DRILL CO.

24 and 26 West Street, Cleveland, O.
101 Chambers Street, New York.
85 Queen Victoria St., London, Eng.



Regular Pump.

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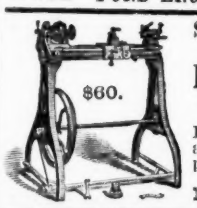

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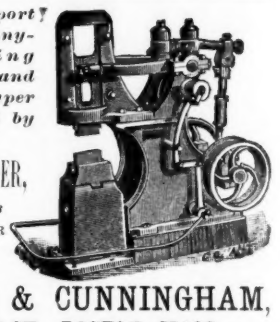

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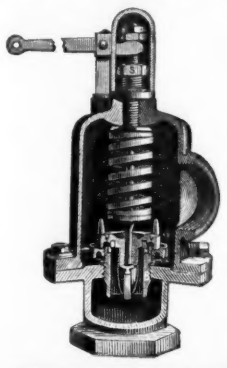

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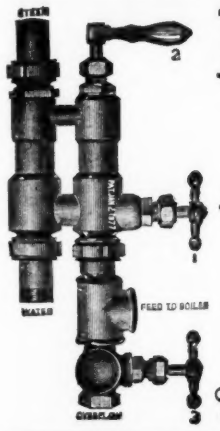

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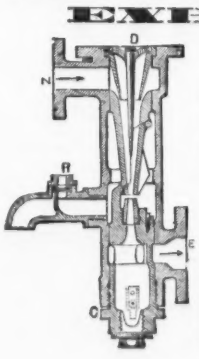

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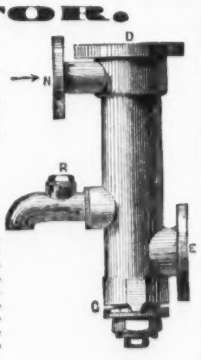

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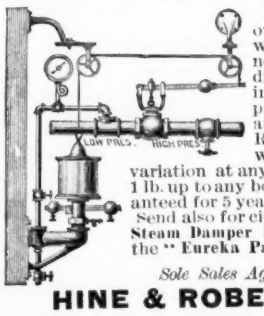

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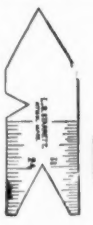

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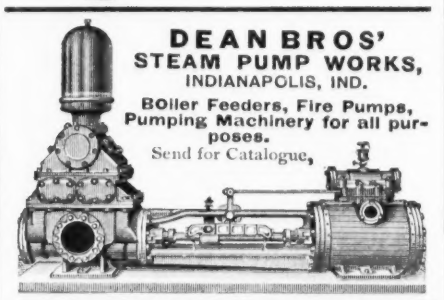

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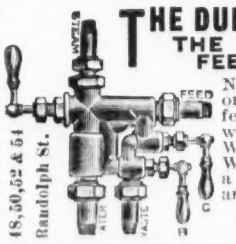

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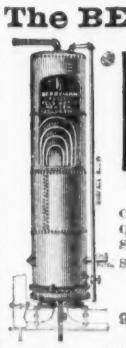

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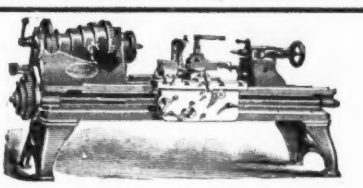

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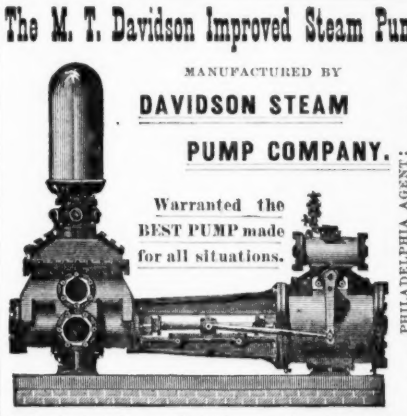

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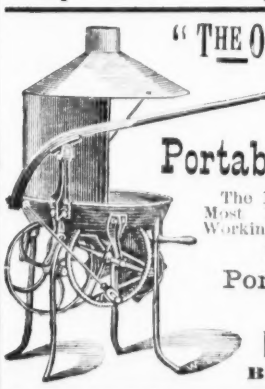

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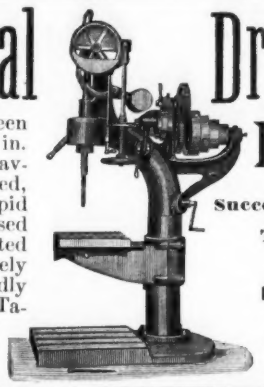

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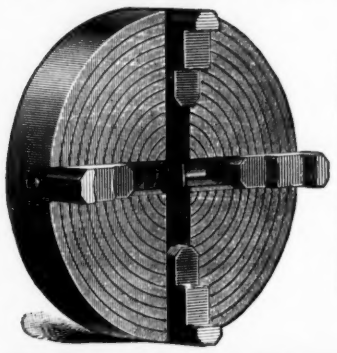

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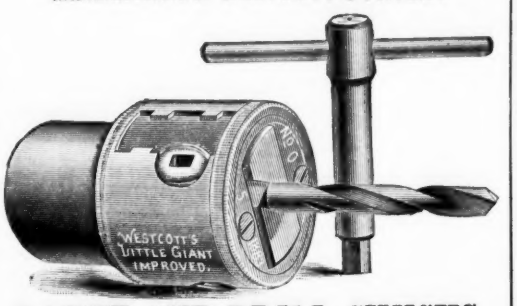

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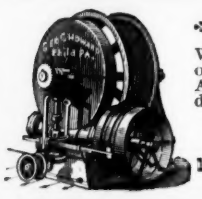

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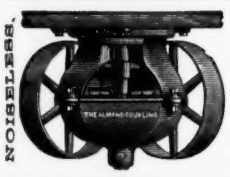

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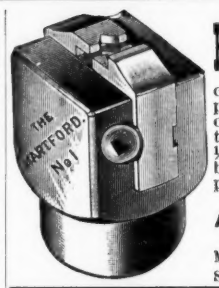

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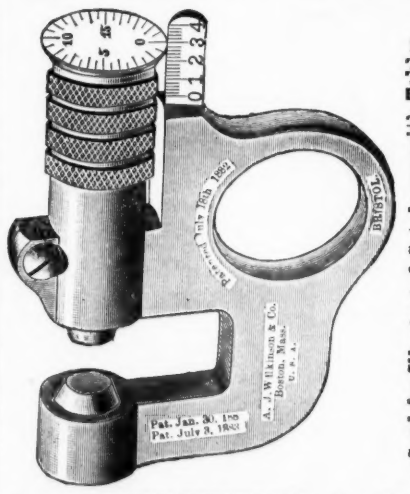

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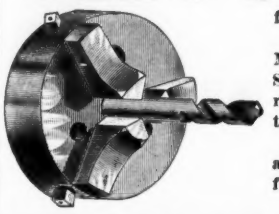

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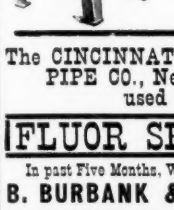

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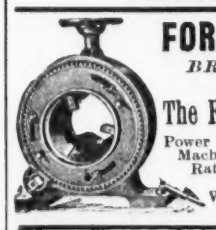

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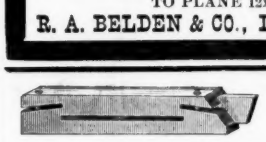

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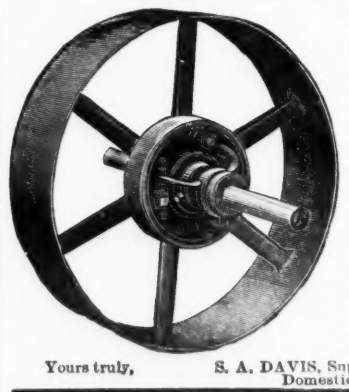

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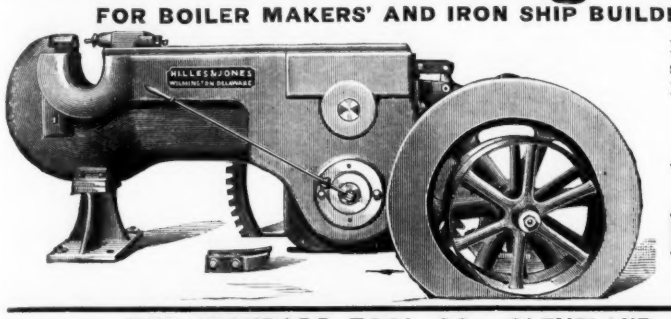

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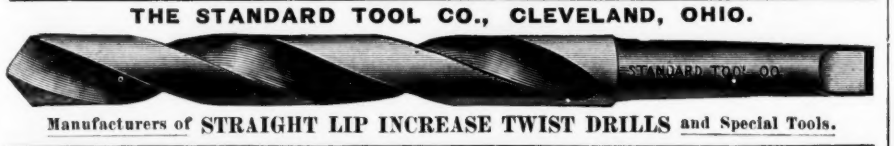

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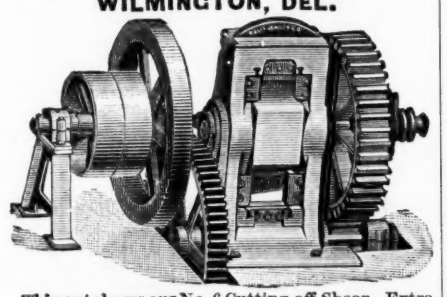

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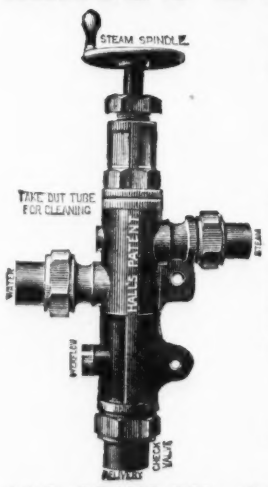

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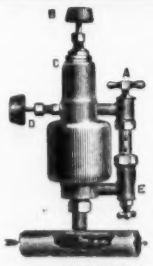

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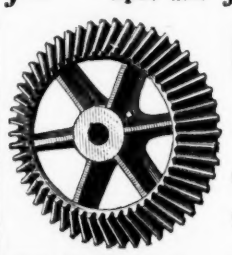

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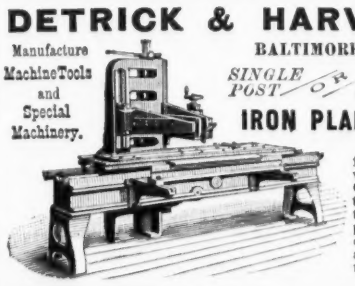

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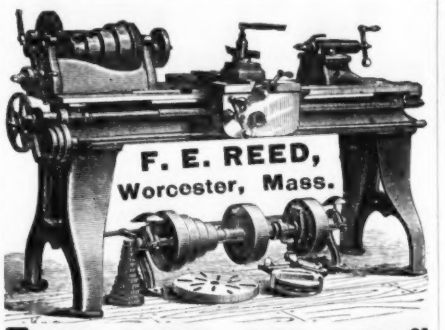

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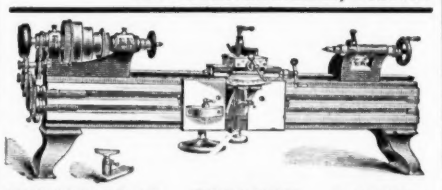

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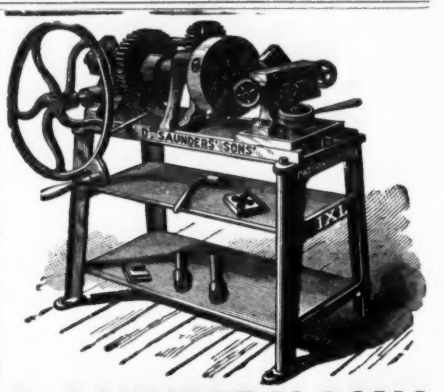

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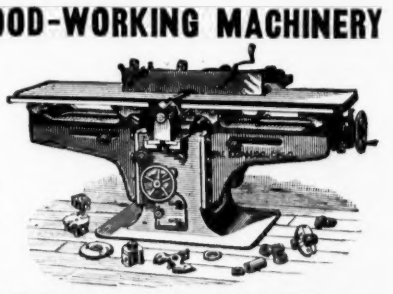

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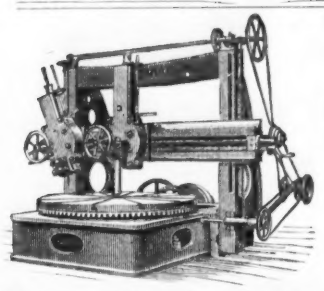

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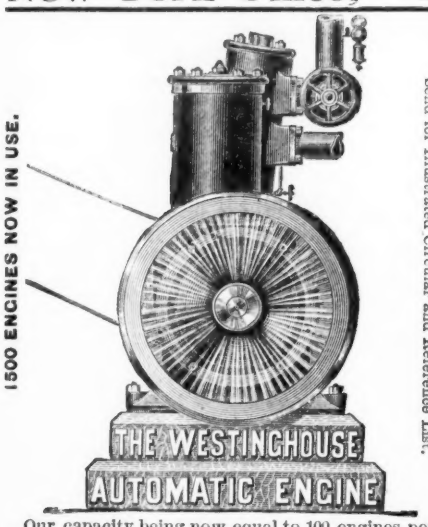

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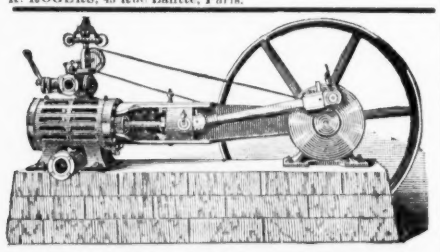

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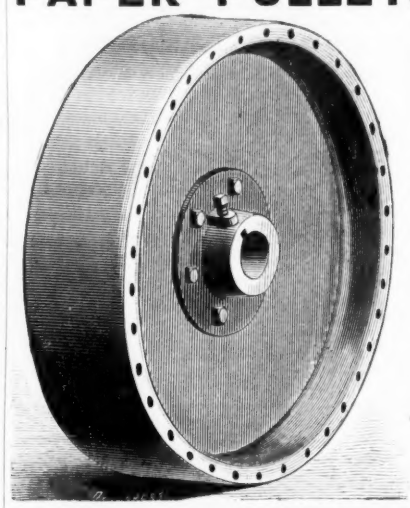

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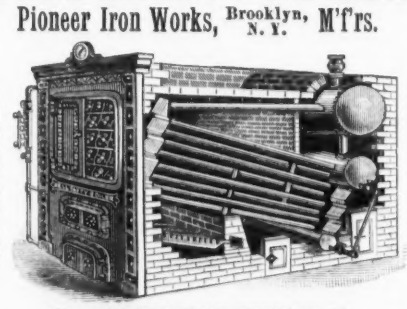

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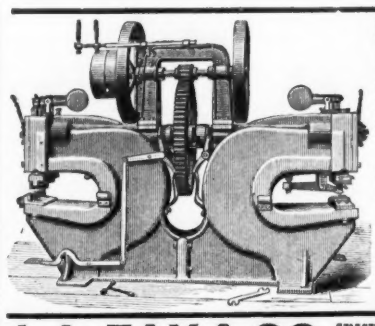

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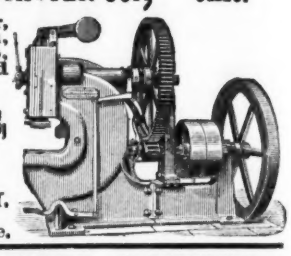

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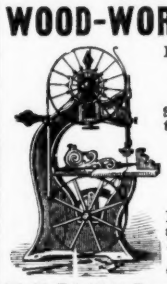

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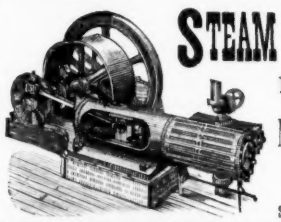

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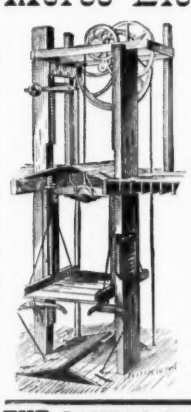

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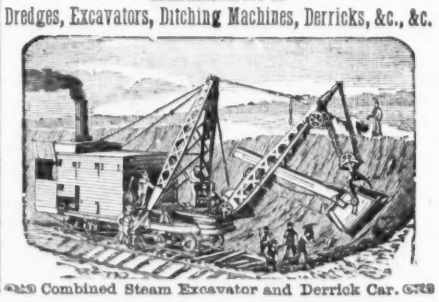

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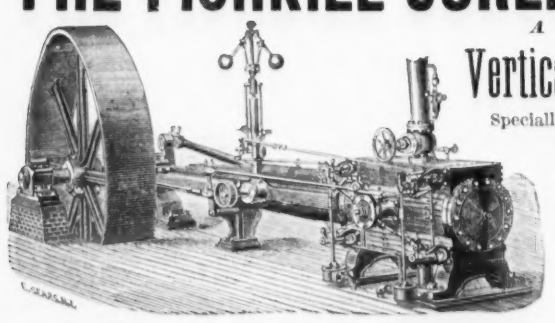

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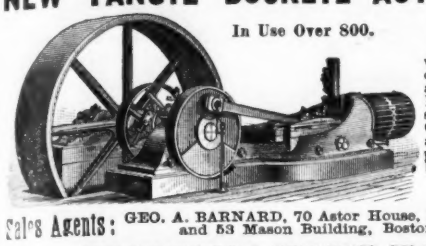

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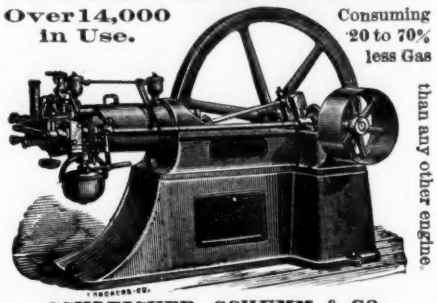

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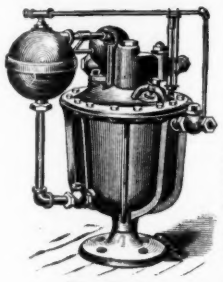

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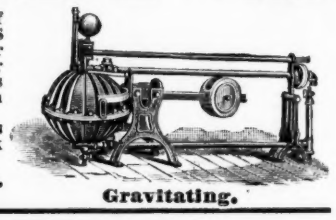

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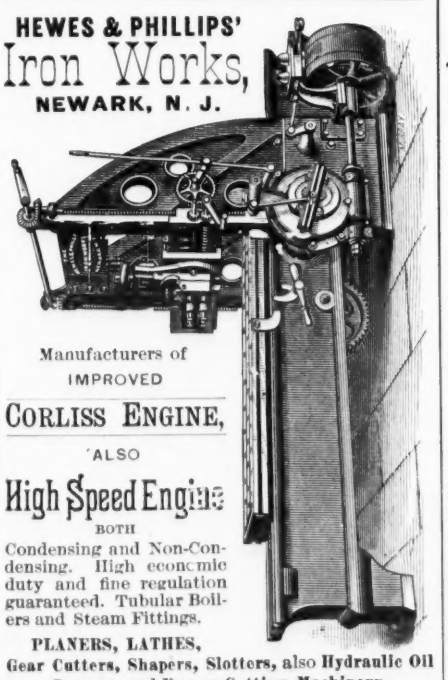

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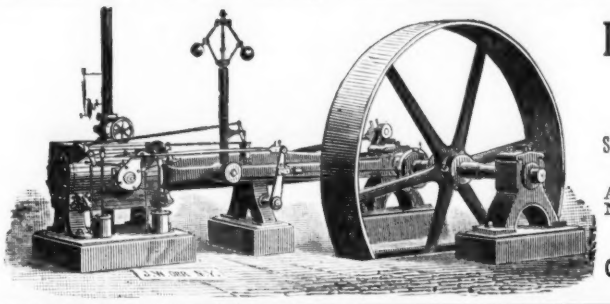

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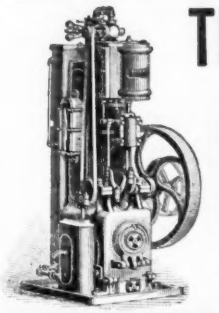

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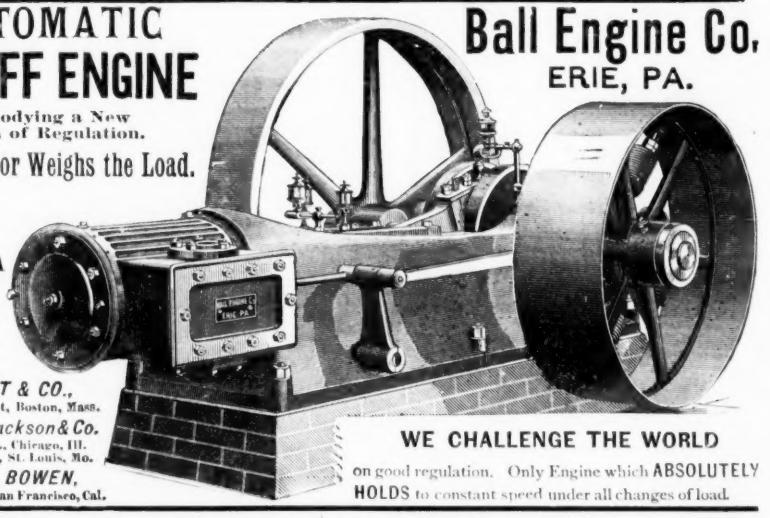

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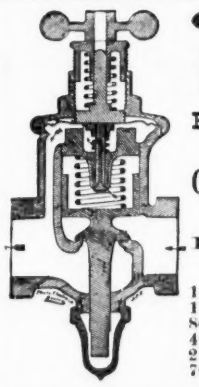

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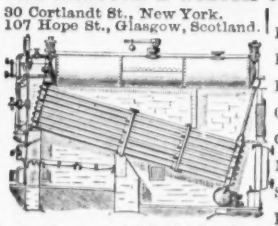

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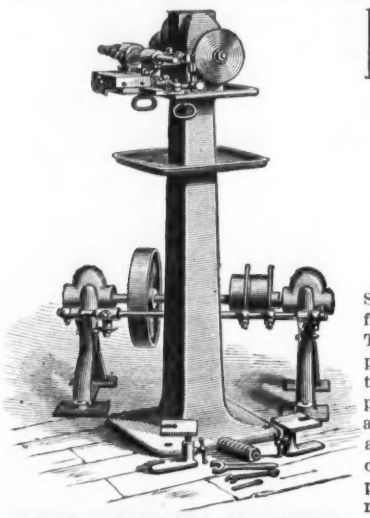

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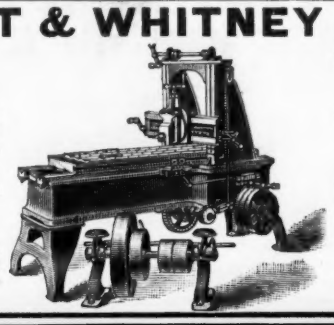

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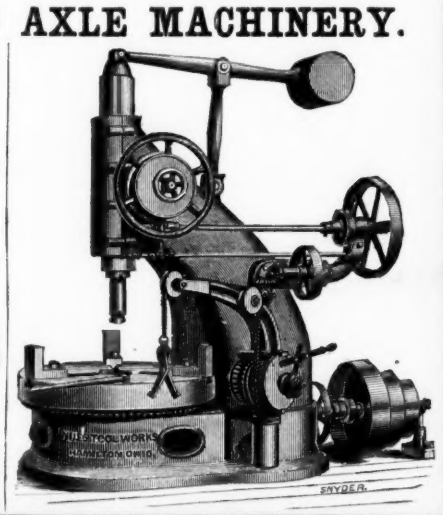

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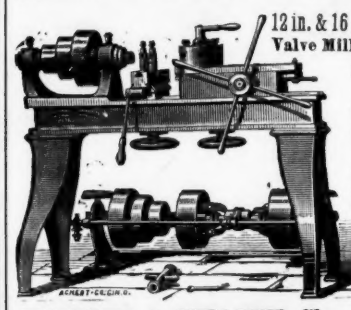

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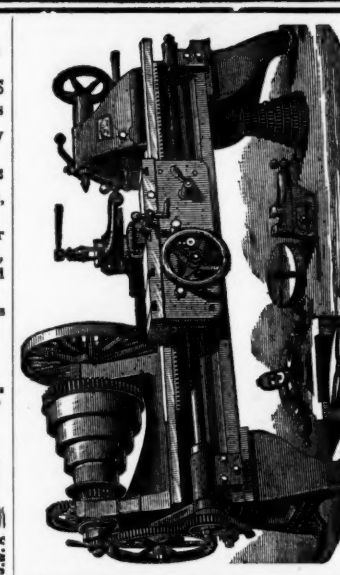

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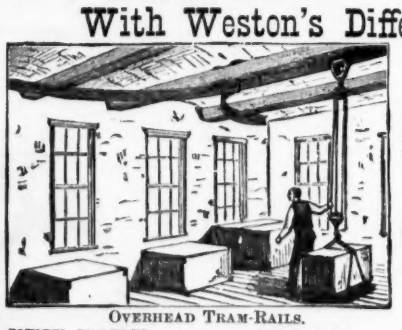

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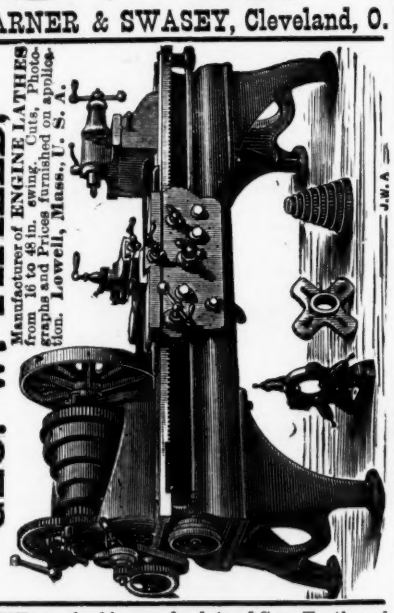

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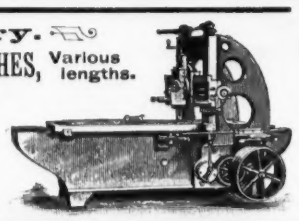

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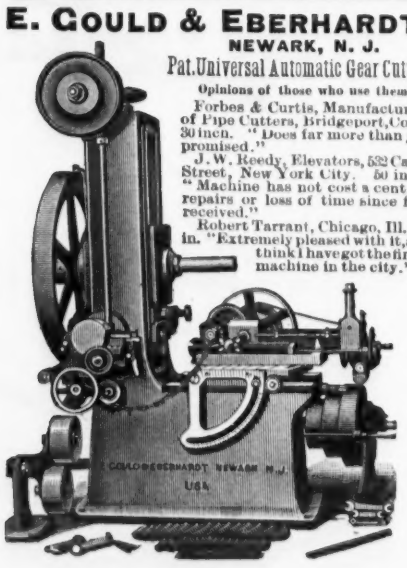

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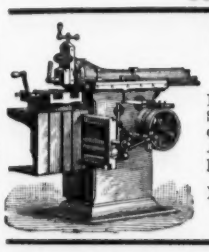

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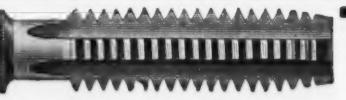

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